Vol. 39 No. 6

BULLETIN

OF THE

TORREY BOTANICAL CLUB

JUNE 1912

The genus Struthiopteris and its representatives in North America—I*

JEAN BROADHURST

(WITH PLATES 21, 22)

Struthiopteris is here used for Willdenow's genus *Lomaria*, which was published first in 1809. It includes also Robert Brown's genus *Stegania* published in 1810. Christensen† reduces *Lomaria* (including *Stegania*) to a subgenus of *Blechnum* and in this subgenus recognizes one hundred species. Including the two North American species placed under *Lomaria* by Willdenow, thirty-six species have been described from North America under the generic name *Lomaria;* this does not include the species since placed in the genera *Stenochlaena*, *Salpichlaena*, and *Plagiogyra*. Twenty-five North American species are recognized by the writer; of these five are new and one must bear a new name.

Though not included by Linnaeus in his Species Plantarum, the genus *Struthiopteris* is much older than 1753. Trevisan‡ gives 1561 for the earliest use of this name and cites Valerius Cordus§ as using *Struthiopteris* to distinguish *Osmunda Spicant* L. It was later used in this sense by several others. The most prominent was probably Haller;‖ in 1742 he used the monomial *Struthiopteris*, citing *Struthiopteris* of Cordus.

Soon after 1753 the generic name *Struthiopteris* was used for

[The BULLETIN for May 1912 (**39**: 209–256. *pl. 16–20*) was issued 8 Je 1912.]

* Based upon a preliminary report which was submitted in partial fulfilment of the requirements for the Degree of Master of Arts in the Faculty of Pure Science, Columbia University.

† Ind. Fil. 150–161. 1905.

‡ Atti Ist. Ven. III. **14**: 553–588. 1869.

§ Hist. Pl. **2**: 170. 1561.

‖ Enum. Stirp. Helv. 132. 1742.

Osmunda Spicant L. by Scopoli, Haller, and Weis. In 1760 Scopoli* used the monomial *Struthiopteris*, and included under it number 844 of Linnaeus;† this species Linnaeus‡ had meanwhile named *Osmunda Spicant*. Therefore, by citation, the correct name of this genus is *Struthiopteris* (Hall.) Scop.

Haller,§ in 1768, again used the monomial *Struthiopteris*, referred to Scopoli's work of 1760, and cited, by number, *Osmunda Spicant* of Linnaeus. The first, however, to publish a binomial under *Struthiopteris* was Weis,|| who in 1770 (two years before Scopoli¶) published *Struthiopteris Spicant*. The correct name for the type species of this genus is therefore *S. Spicant* (L.) Weis. Willdenow,** in 1787, referred to *Struthiopteris Spicant* Weis as a synonym of *Osmunda Spicant*. Swartz†† later included *Struthiopteris* in a list of generic synonyms for this species. Neither Swartz, however, nor Willdenow adopted it.

In the first decade of the nineteenth century four writers, Bernhardi, Robert Brown, Swartz, and Willdenow, each added somewhat to the confusion regarding the correct name of this genus. Bernhardi‡‡ published a similar name, *Struthopteris*, for three other ferns of the Linnaean genus *Osmunda* (*O. cinnamomea*, *O. Claytoniana*, and *O. regalis*) with the caution that it was not to be confounded with *Struthiopteris* Hall. Willdenow§§ published *Struthiopteris* for *Osmunda Struthiopteris* L. and an undescribed "*Struthiopteris* from Pennsylvania" (which he described in 1810 as *S. pennsylvanica*). Three of these workers transferred *Osmunda Spicant* L., the type of the genus *Struthiopteris*, to other established genera: Bernhardi||| to *Asplenium*, Willdenow ¶¶ to *Acrostichum*, and Swartz *** to *Blechnum*. Swartz †††also placed several

* Fl. Carn. 168. 1760.
† Fl. Suec. 307. 1745.
‡ Sp. Pl. 1066. 1753; Fl. Suec. 370. 1755.
§ Hist. Stirp. Helv. **3**: 6. 1768.
|| Pl. Crypt. Fl. Gott. 286. 1770.
¶ Fl. Carn. **2**: 288. 1772.
** Prod. Fl. Berol. 289. 1787.
†† Under *Blechnum boreale;* Syn. Fil. 115. 1806.
‡‡ Jour. Bot. Schrad. **1800**[2]: 126. 1801.
§§ Ges. Nat. Fr. Berl. Mag. **3**: 160. 1809.
||| Jour. Bot. Schrad. **1799**[1]: 309. 1799.
¶¶ Prod. Fl. Berol. 289. 1787.
*** Syn. Fil. 115. 1806.
††† Prod. 127. 1788; Fl. Ind. Occ. **3**: 1583–1586, 2010. 1806.

related species first in *Osmunda* and later (following Hoffman*) in *Onoclea*. Later Willdenow and Brown each published new generic names for part of the genus under discussion. Willdenow,† in 1809, published the genus *Lomaria*, citing all of *Onoclea* of Swartz except *O. sorbifolia* as the basis of the name; and in the following year Willdenow‡ listed under *Lomaria* most of Swartz's species of *Onoclea*. In 1810 Robert Brown§ published *Stegania*, before mentioned, for eight African members of this genus. In so doing he separated *Spicant* from its relatives, just as Swartz had done when he placed it under *Blechnum*, and its relatives under *Osmunda* and later *Onoclea*.

This confusion has continued even to the present, although two authorities, Trevisan‖ and Underwood,¶ have shown independently (1) that *Osmunda Spicant* L. has "first claim to *Struthiopteris*, becoming *Struthiopteris Spicant*," and (2) that the correct generic name for *Osmunda Struthiopteris* L. is not *Struthiopteris* but *Matteuccia*, established by Todaro** in 1866.

Trevisan attempted to divide the genus *Struthiopteris*, recognizing *Lomaria* Willd. for part of it. In his key he describes *Struthiopteris* as having median sori and ascribes marginal sori to *Lomaria*. Trevisan discusses but three of the North American species, *Spicant*, *doodioides*, and *polypodioides*, which he places under *Struthiopteris*. A careful examination of the North American material in the New York Botanical Garden herbarium does not justify this division. The term "median" is not applicable, even relatively, to the indusium in any of this material; the sterile extension outside the indusium may be perceptibly wider in the young leaves, but the conditions in the mature fronds do not justify the use of the term. Nor do *S. Spicant* and *S. polypodioides* differ from any of the other species in the relative position of the indusium.

---

* Deutsch. Fl. **2**: 12. 1795.

† Ges. Nat. Fr. Berl. Mag. **3**: 160. 1809.

‡ Sp. Pl. **5**: 289. 1810.

§ Prod. Fl. Nov. Holl. 152. 1810.

‖ Atti Ist. Ven. III. **14**: 556. 1869.

¶ Mem. Torrey Club **6**: 257. 1899.

** Giorn. Sci. Nat. **1**: 208–254. 1866. Todaro also recognized the priority of *Struthiopteris Spicant* for *Osmunda Spicant* L.

Other possible divisions of this large genus, based upon characters offered by the sterile fronds, the indusium, and the sporangia and spores, have been considered by the writer and found unsatisfactory for the following reasons: (1) The variations in the sterile leaves in proportion, cutting, and texture depend greatly upon the age of the leaf and of the plant; (2) in the fertile leaves the indusium remains entire in the pinnatifid species, and though it usually becomes lacerate or fimbriate in the pinnate species, these show all degrees of laceration; (3) a careful microscopic study of the spores and sporangia, which Fée apparently considered important, reveals no constant differences in the North American species.

The greatest variation is undoubtedly in the habit, for the North American species include: (1) Tree-climbing forms with pendent leaves, (2) terrestrial, cespitose forms, (3) terrestrial, inclined or erect forms with stems 5–45 cm. long, and (4) subarboreous forms with stems at least 20 cm. high and 12 cm. thick. These differences we are at present unable to correlate with any other character. The habits of some species are not definitely known, because collectors have so often brought back incomplete specimens without field notes; mention of the habit is rarely included in the original description; and further, even American writers have confused our own species with the descriptions of African and other foreign ones and attributed to them characters they never possess. In making the key for this genus, habit has therefore been almost ignored; the key is strictly artificial and based mainly upon the frond characters rather than upon those of the whole plant.

The following key and descriptions have been based chiefly upon the specimens in the herbaria of the New York Botanical Garden and the United States National Museum. Begun under the direction of Professor Lucien M. Underwood, this paper has been completed with assistance from Mr. William R. Maxon and Dr. Ralph C. Benedict. Dr. H. Christ and Dr. B. P. G. Hochreutiner also kindly sent tracings or material from their herbaria. Access was freely given to the herbaria at Geneva and Kew.

STRUTHIOPTERIS (Hall.) Scop.

Fronds dimorphous (otherwise resembling *Blechnum*), usually pinnatifid or once pinnate; veins free, simple or usually once forked, usually not reaching the margin; sori linear and intramarginal (not costal as in *Blechnum*); indusium intramarginal in attachment,* at maturity opening toward the midrib, and then either (1) entire and not reflexed or (2) more or less lacerate or fimbriate and reflexed.

Key to the non-petioled species†

A. STERILE PINNAE NEVER PETIOLED, THE WHOLLY ADNATE BASE THE WIDEST PART OF THE PINNA; RHIZOME SCALES NEVER RIGID; PINNAE LACKING SCALES; INDUSIUM NOT LACERATE WITH AGE

Plants epiphytic; rhizome wide-creeping; rhizome scales and basal stipe scales usually with a black median line (wholly lacking in *S. Plumieri*); stipes scattered, the fertile ones straw-colored or bicolored with dull brown or blackish; mature lamina not punctate by transmitted light; fertile pinnae not conspicuously dilated at their bases.

Lamina broadly oblong, very abruptly reduced at the base (type A,‡ with vestigial pinnae); pinnae 22–28-jugate, 16–18 cm. long, straight or nearly so, the middle ones always straight. 1. *S. ensiformis.*

Lamina linear or very narrowly oblong to broadly lanceolate, gradually to abruptly reduced at the base (type G to D, with vestigial pinnae in D only); pinnae 25–75-jugate, 2.5–16 cm. long, slightly curved to falcate, the middle ones always falcate.

Rhizome scales usually with a black median line; lamina linear, narrowly oblong, or lanceolate, 4–17 times as long as broad, usually very gradually reduced at the base (type G to F, rarely E); leaf tissue rigid-herbaceous; pinnae usually contiguous. 7. *S. polypodioides.*

* The intramarginal character of the indusium is obscured in many of the pinnate species by the thickened edges of the pinnae, due to the more or less glandular thickening of the vein apices. In the sterile pinnae these thickenings may result in dark spots, slight swellings, circular cartilaginous areas or depressions, or occasionally in more or less detachable scalelike elevations.

† The species having petioled sterile pinnae will be discussed in a later number of the BULLETIN OF THE TORREY BOTANICAL CLUB. The sterile fronds of the non-petioled species are cut to the rachis, but the bases of the pinnae are wholly adnate, and except in a few specimens of *S. ensiformis*, the base is always the widest part of the pinna. Fée and others classify these as pinnatifid. Petiole instead of petiolule is used throughout when referring to the pinnae.

‡ See FIGURE 1, which gives several diagrams illustrating the variation in the bases of the laminae.

Rhizome scales never with a black median line; lamina broadly lanceolate to lanceolate, 2.5–4.5 times as long as broad, usually abruptly reduced below (type D to E, with vestigial pinnae); leaf tissue membranous to herbaceous; pinnae distant in the basal half to third of the lamina. 6. *S. Plumieri.*

Plants terrestrial; rhizome inclined to erect; rhizome scales and basal stipe scales never with a black median line; stipes clustered at the apex of the rhizome, the fertile ones partly, or oftener wholly, shining chestnut to black; mature lamina fully punctate by transmitted light (see *S. Spicant* for exceptions); fertile pinnae conspicuously dilated at their bases (except in *S. Maxonii*).

Sterile lamina gradually reduced at the base (type F–G, without vestigial pinnae); vein spaces 8–15 to 1 cm.

Rhizome erect (43 cm. high, in type); vein spaces 8–10 to 1 cm.; fertile pinnae not dilated at their bases. 5. *S. Maxonii.*

Rhizome creeping or stoloniferous; vein spaces 10–15 to 1 cm.; fertile pinnae conspicuously dilated at their bases.

Sterile fronds of two types in texture and position, 20–70 cm. long; rhizome apparently not stoloniferous; pinnae 36–80-jugate, 3–15 times as long as wide. 8. *S. Spicant.*

Sterile fronds similar in texture at least, 11–20 cm. long; rhizome stoloniferous; pinnae 16–22-jugate, 1–3 times as long as wide. 9. *S. stolonifera.*

Sterile lamina abruptly reduced at the base (type B–D, with vestigial pinnae except in *S. L'Herminieri*); vein spaces 6–8 to 1 cm.

Stipes (of the sterile fronds, at least) without scarlike vestigial pinnae; lamina lanceolate, 5–11 cm. wide; pinnae mainly falcate, ascending. 4. *S. L'Herminieri.*

Stipes with vestigial pinnae; lamina elliptical, ovate-lanceolate, oblong-deltoid, or deltoid, 12–32 cm. wide; pinnae mainly straight, diverging.

Lamina of mature fronds deltoid to oblong-deltoid, or ovate-lanceolate and very abruptly reduced below (type A or B); lower pinnae contiguous, if shorter abruptly reduced to semicircular lobes; sporophyls fertile on the dilated bases of the pinnae. 2. *S. exaltata.*

Lamina of mature fronds broadly elliptical, less abruptly reduced below (type D); lower pinnae distant or appearing so, always shorter; sporophyls not fertile on the dilated bases of the pinnae. 3. *S. jamaicensis.*

1. S. ENSIFORMIS (Liebm.) Broadh.; Maxon, Contr. U. S. Nat. Herb. **13**: 17. 1909.

Lomaria ensiformis Liebm. Vid. Selsk. Skr. V. 1: 82. 1849.
Blechnum ensiforme C. Chr. Ind. Fil. 153. 1905.

Plants epiphytic. Rhizome creeping, 5–7 cm. long in fragments seen, the scales linear, 5–10 mm. long, maroon to tobacco brown, with a black median line. Sterile fronds 90–100 cm. long; stipes scattered, 20–28 cm. long, channeled on the upper side,* not angulate, marked about halfway down by scarlike undeveloped pinnae, bicolored, the darker side dark chocolate brown, the deciduous basal stipe scales† smaller than the scales of the rhizome; lamina 40–68 cm. long, 25–35 cm. wide, broadly oblong, abruptly reduced at the base (type A, but with vestigial pinnae as described above), the apex gradually reduced, the terminal pinna 5–8 cm. long, the pinnae more or less opposite, the lower ones distant, sometimes 2–3 cm. apart; pinnae 22–28-jugate, narrowly oblong to linear, straight, not falcate (if curved, only near the apex), horizontal or ascending, 16–18 cm. long, 12–17 mm. wide,‡ long-acuminate, the base dilated in the upper pinnae, in the lower ones occasionally slightly contracted; margins entire (or barely subentire near the apex, not definitely serrate), not at all or very slightly revolute; leaf tissue rigid-herbaceous, without scales; veins not conspicuous, usually sunken on the under side, the vein apices with very slight swellings or depressions, the vein spaces 10–13 to 1 cm. Sporophyls 60–70 cm. long; stipes§ 20–28 cm. long, straw-colored or bicolored; lamina 32–45 cm. long, gradually reduced toward the apex, the terminal pinna 5–10 cm. long; pinnae 20–30-jugate, 10–20 cm. long, 3–4 mm. wide, with a sterile tip 3–6 mm. long, the base contracted (occasionally dilated below the contraction); indusium rather heavy, entire, not becoming lacerate; sporangia dark brown.

TYPE LOCALITY: Oaxaca, Mexico.

DISTRIBUTION: Mexico, Guatemala, Costa Rica, and Panama.

SPECIMENS INCLUDED: GUATEMALA: Baja Verapaz, "Hochwald bei Purulha," altitude 1,800 m., *von Türckheim 1693* (Y, N).‖

* In all of the species included in this paper the rachis and stipe are channeled on the upper (ventral) side; that statement is not, therefore, repeated in the following descriptions.

† Unless otherwise described in the following species, the basal stipe scales are shorter and more deciduous than the rhizome scales but similar in color and texture.

‡ Throughout this paper the measurements of the pinnae are those of the largest lateral ones; the width is measured at the adnate base of the non-petioled pinnae.

§ Vestigial pinnae, scales, etc., as in the sterile stipes. This likeness will be understood hereafter, unless they are described separately.

‖ N indicates that the specimen cited is in the United States National Herbarium; Y, in the herbarium of the New York Botanical Garden.

Alta Verapaz, "Waldungen," Pansamala between S. Pedro Cariha and Senahu, altitude 3,800 ft., *von Türckheim 640* (N). Alta Verapaz, near the Finca Sepacuite, *Cook & Griggs 417* and *420* (N).

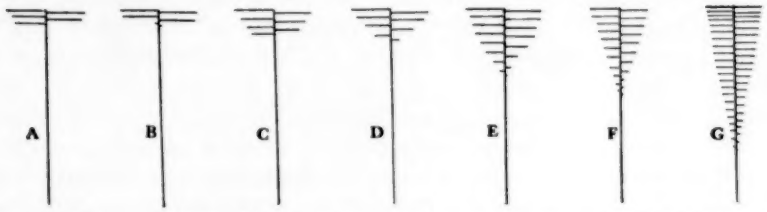

FIGURE 1. Types of frond bases found in the North American species of *Struthiopteris*.

The adnate dilated bases mentioned by Liebmann are most characteristic of the specimens mentioned above; though no Mexican specimens have been seen, Liebmann's full description leaves no doubt that the Guatemalan specimens belong to this species.

The Costa Rican and Panama specimens examined differ in being more gradually reduced at the base (type C), in having proportionately broader pinnae which are more abruptly acuminate, and in having shorter lower pinnae (4–6 cm. long) which are more contracted at the base and farther apart (2–4 cm.). The three Costa Rican specimens, *Pittier 10176* ("Forêts de la Palma," Pacific slopes) and U. S. National Herbarium no. 575237 and no. 575239 (both the latter without definite locality, collected by Wercklé, 1901–1905) are in these respects intermediate between the Guatemalan plants and the one from Panama, *Maxon 5526* (humid forests of Cuesta de Las Palmas, southern slope of Cerro de la Horqueta, Chiriqui, altitude 1,700–2,100 m.). Since Pittier's no. 10176 is the only one with a fertile frond it does not seem best to separate these more southern plants at present.

2. **S. exaltata** (Fée) Broadh. comb. nov.

Lomaria exaltata Fée, Mém. Foug. 11: 10. *pl. 3*. 1866.

Plant terrestrial. Rhizome erect or ascending, 4–40 cm. long, the scales lanceolate to ovate-lanceolate, about 1 cm. long, 2–2.5 mm. wide, tobacco brown. Sterile fronds 30–90 cm. long; stipes 20–30 cm. long, slightly to decidedly angulate, marked usually

throughout with vestigial pinnae varying from mere scars to lines about 1 cm. long, bicolored; lamina 22–47 cm. long, 12–24 cm. wide, deltoid to oblong-deltoid or ovate-lanceolate, the base abruptly reduced (type A or B, with vestigial pinnae), with or without 1–3 more or less semicircular contiguous lobes, gradually reduced at the apex, the terminal pinna 5–9 cm. long, the pinnae usually alternate, the lower more or less diverging but contiguous; pinnae 9–18-jugate, broadly triangular to oblong, straight (or the upper ones slightly curved), the apex acute, never acuminate, sometimes contracted near but not at their bases, 6–12 cm. long, 1.5–3 cm. wide; margins entire, not at all or but irregularly and slightly revolute; leaf tissue rigid-herbaceous, closely and markedly punctate, showing throughout rounded translucent spaces when held to the light, without scales; veins rarely conspicuous, never raised or grooved, usually ending in circular glandular swellings or in depressions which occasionally hold a more or less separable, central, scalelike swelling, the vein spaces 6–7 to 1 cm. Sporophyls 44–90 cm. long, taller than the sterile in all the complete specimens seen; stipes 24–40 cm. long, marked with vestigial pinnae, usually reddish brown, occasionally purplish black, not bicolored as in the sterile, though sometimes lighter on the upper side; lamina 22–40 cm. long, abruptly reduced at the base, gradually at the apex, the terminal pinna 5–10 cm. long; pinnae 12–22-jugate, 11–14 cm. long, 3–4 mm. wide, often with a sterile tip 3–7 mm. long, broadly dilated both ways at the base and fruited on the dilations; indusium not heavy, entire, not becoming lacerate; sporangia varying from yellow to dark brown.

TYPE: Fée, Mém. Foug. 11: *pl. 3.* 1866. Collected by L'Herminier in 1861, Guadeloupe.

DISTRIBUTION: Jamaica, Porto Rico, the Lesser Antilles (St. Kitts, Montserrat, Guadeloupe, Dominica, and Martinique), Costa Rica, and Panama.

SPECIMENS INCLUDED: PORTO RICO: Luquillo Mountains, *Wilson 135* (Y). ST. KITTS: Top of Mt. Misery, under cliff, *Britton & Cowell 546* (Y). MONTSERRAT: Chance's Mountain, at the top, altitude 3,000 ft., *Shafer 273*. GUADELOUPE: *Duss 4167.4166*,* (Y, N). DOMINICA: Mt. Diablotin, *Lloyd 880* (Y) and *893* (Y, N).

This has been confused by Jenman and by some European

* Often the localities given on the Duss sheets are descriptive rather than specific: different localities are given for sheets bearing the same collection number, or several localities are given on one sheet. The locality is, therefore, omitted in such cases.

writers with *Lomaria Plumieri* Desv. The broad, horizontal pinnae pictured in the type of *exaltata* separate it positively from *Plumieri* with its narrow, falcate pinnae, pictured by Plumier. *L. mucronata*, which Christensen refers to *Plumieri*, is much nearer *exaltata*. Fée, in this, as in several other original descriptions, makes contradictory statements regarding the size. This mistake led to two others: (1) the publication of *L. Féei* as a distinct species; and (2) the placing of *L. exaltata* under *L. L'Herminieri* as a variety. Christensen includes *exaltata* in *L'Herminieri;* although the immature sterile laminae of *exaltata* sometimes resemble the mature ones of *L'Herminieri* in proportion and in the shape of the pinnae, they seem otherwise distinct.

Four sheets from Grenada, collected by Sherring (October to May, 1890–91) show young specimens, which are more delicate in texture and bear pinnae which are shorter and more like those of *L'Herminieri*. The basal reduced pinnae are prominent, more numerous, and contiguous. They are accompanied by taller but immature fertile fronds; no mature sterile or fertile fronds from the island have been seen. At present it seems best to leave these Sherring specimens in *S. exaltata*.

Three sheets from Costa Rica ("Forêts de l'Achiote, Volcan de Poas," altitude 2,000 m., *Tonduz 10709*) have laminae with wider sinuses, and occasionally 2 or 3 pairs of semicircular lobes at the base. The pinnae are proportionately as well as actually narrower, and the fronds have an open appearance not really characteristic of the species. Christ named them *L. L'Herminieri*, but they seem much nearer *exaltata*, especially in the shape of the lamina and of the pinnae. Maxon's no. 5671 (humid forests of the upper Caldera watershed, between "Camp I" and the Divide, Holcomb's trail, above El Boquete, Chiriqui, altitude 1,650–1,925 m.) has pinnae which are more curved; Maxon's no. 5427 from the same region (humid forest around Los Siguas Camp, southern slope of Cerro de la Horqueta, Chiriqui, altitude about 1,700 m.) has wider sinuses in the lower part of the lamina, and the vestigial pinnae are much more prominent than in the other specimens seen.

3. **S. jamaicensis** Broadh. sp. nov.

Plant terrestrial. Rhizome ascending, 24 cm. long (in the one

complete specimen seen), 2–3 cm. thick; the scales very scanty, ovate-lanceolate, about 1 cm. long, tobacco brown. Sterile fronds 80–100 cm. long; stipes numerous, close, 27–45 cm. long, usually somewhat angulate, marked throughout with vestigial pinnae, which vary from mere scars to wide but very short lobes, chestnut to reddish purple and black, light colored in the channel, scales usually lacking; lamina 60–80 cm. long, 20–32 cm. wide, elliptical, rather abruptly reduced at the base (type D, with vestigial pinnae), the lower pinnae more or less distant (1 cm.), gradually reduced at the apex, the terminal pinna 3–8 cm. long, rachis light colored on the upper side; pinnae 18–35-jugate, the upper curved or falcate, the lower less curved to straight and oblong, the apex attenuate, the base broadly dilated, especially in the lower pinnae, which are 10–16 cm. long, 1–2 cm. wide (the lowest ones 3–6 cm. long and 2.5–3.5 cm. wide at their bases); margins entire, unevenly or not at all revolute; leaf tissue membranous to herbaceous, punctate as in *S. exaltata*, without scales; veins distinct, never raised nor grooved, the apices glandular as in *exaltata*, vein spaces 6–8 to 1 cm. Sporophyls 88 cm. long (in the only complete one seen); stipes 30–40 cm. long, lighter than the sterile, the vestigial pinnae less prominent; lamina 45–52 cm. long, abruptly reduced at the base, the apex gradually reduced; pinnae 24–30-jugate, 10–15 cm. long, 3–4 mm. wide, the apex with a sterile tip 1–5 mm. long, the base dilated; indusium entire, not becoming lacerate; sporangia greenish yellow in fresh specimens. [PLATE 21.]

Type in the U. S. National Herbarium, no. 429499 and 429500, and in the New York Botanical Garden, collected near a stream in a wet ravine, forest near Hardware Gap, Jamaica, altitude 4,200 feet, *William Harris 10099*, February 19, 1908.

The type collected in 1908 has made possible the separation from *S. exaltata* of several incomplete specimens in the herbaria at Geneva and New York. *S. jamaicensis* differs from *S. exaltata* in being thinner in texture, widest at the middle, and in having more numerous pinnae with acuminate tips; it differs also in having lower pinnae which are much more dilated at the base, and which, if not separated, appear so because of the flaring sinuses; the fertile pinnae are evidently not soriated on the dilations as in *S. exaltata*.

4. **S. L'Herminieri** (Bory) Broadh. comb. nov.

Lomaria L'Herminieri Bory; Kunze, Farrnkr. 173. *pl. 73*. 1845.
Lomaridium Herminieri Presl, Epim. Bot. 263. 1851.

Spicanta L'Herminieri O. Kuntze, Rev. Gen. Pl. **2**: 820. 1891.
Blechnum L'Herminieri C. Chr. Ind. Fil. 156. 1905.

Plants terrestrial. Rhizome ascending to erect, at least 4–15 cm. high, the scales not numerous, lanceolate to ovate-lanceolate, tobacco brown. Sterile fronds 30–48 cm. long; stipes 4–12 cm. long, not at all or somewhat angulate, without vestigial pinnae, bicolored; lamina 18–32 cm. long, 5–11 cm. wide, lanceolate, abruptly reduced at the base (type A or B), usually with 2 or more pairs of somewhat semicircular, contiguous lobes at the base, gradually reduced at the apex, with a terminal pinna 2–6 cm. long, the pinnae sometimes opposite; pinnae 7–16-jugate, the upper ones falcate, the lower ones more or less falcate, the apex acute, never acuminate, the base more or less dilated, 3.5–6 cm. long, 10–18 mm. wide; margins entire, slightly and only irregularly revolute; leaf tissue rigid-herbaceous, without scales; veins distinct, not definitely raised or grooved, the apices somewhat glandular, the vein spaces 6–8 to 1 cm. Sporophyls 26–50 cm. long, and often but little taller than the accompanying sterile fronds; stipes 13–35 cm. long, straw-colored to brownish, occasionally slightly purplish, but slightly or not at all marked with vestigial pinnae in the upper part; lamina 13–24 cm. long, abruptly reduced at the base, gradually reduced at the apex; pinnae 10–17-jugate, 4–9 cm. long, 2–3 mm. wide, with or without a constricted sterile tip, the base widely dilated, not fruited on the dilations; indusium not heavy, entire, not becoming lacerate; sporangia dark brown.

TYPE: *Bory 201*, from Guadeloupe (Kunze also cites *Linden 193* and *Moritz 31*, both from Caracas).

DISTRIBUTION: Known from Guadeloupe, Martinique, and Dominica.

SPECIMENS INCLUDED: GUADELOUPE: *Duss 4166* (Y, N); *Duss 4167* (N). DOMINICA: Mt. Diablotin, *Lloyd 885* (N). MARTINIQUE: *Duss 1554* (Y).

5. **S. Maxonii** Broadh. sp. nov.

Plants terrestrial. Rhizome erect, 43 cm. high (in type specimen), the scales numerous at the apex, linear to lanceolate, 5–10 mm. long, purplish brown to black. Sterile fronds 25–38 cm. long; stipes 3–6 cm. long, not at all or but slightly angulate, without vestigial pinnae, straw-colored or bicolored with reddish brown or brown, the scales not numerous, very deciduous, ovate to lanceolate, 3–5 mm. long, dull brown; lamina 22–35 cm. long, 3–5 cm. wide, narrowly elliptical, gradually reduced at the base (type F), gradually reduced at the apex, the terminal pinna 1–4

cm. long, the lower pinnae often opposite; pinnae 16–26-jugate, falcate, the apex rounded to subacute, the base somewhat dilated, 2–3 cm. long, 8–12 mm. wide; margins not at all or slightly and irregularly revolute; leaf tissue rigid-herbaceous, punctate as in *S. exaltata*, without scales; veins not distinct, occasionally slightly grooved below, the apices marked with circular glandular areas, vein spaces 8–10 to 1 cm. Sporophyls 25–28 cm. long; stipes 1–5 cm. long, usually bicolored with reddish brown; lamina 14–16 cm. long, abruptly reduced below, gradually reduced above; pinnae 14–18-jugate, 2–3.5 cm. long, 2 mm. wide, with a sterile tip 1–2 mm. long, the base but slightly or not at all dilated; indusium delicate, entire, not becoming lacerate; sporangia yellowish or brownish yellow to brown. [PLATE 22.]

Type in the U. S. National Herbarium, no. 675793 and 675794, collected in humid forests around Los Siguas Camp, southern slope of Cerro de la Horqueta, Chiriqui, altitude about 1,700 meters, *William R. Maxon 5415*, March 17–19, 1911.

SPECIMENS INCLUDED: COSTA RICA: "Barba, borde du Rio Máncaron," altitude 1,200 m., *Pittier & Durand 2001*. U. S. National Herbarium no. 154300, without definite locality and collection number, *Cooper*.

In a cover with some South American plants marked tentatively sp. nov. by Professor L. M. Underwood, are two sheets from Colombia (altitude 5,000 feet, *H. Smith 1084*). One has a rhizome 33 cm. high, and they surely belong in this species.

6. **S. Plumieri** (Desv.) Broadh. comb. nov.

Lomaria Plumieri Desv. Ges. Nat. Fr. Berl. Mag. **5**: 325. 1811.

Lomaria martinicensis Spreng. Neue Entd. **3**: 5. 1822 (cited by Desvaux in 1827 as a synonym).

Lomaridium Plumieri Presl, Epim. Bot. 155. 1851.

Spicanta Plumieri O. Kuntze, Rev. Gen. Pl. **2**: 820. 1891.

Blechnum Plumieri Diels, in E. & P. Nat. Pfl. **1**[4]: 248. 1899.

Plants epiphytic. Rhizome creeping on rocks and trees, at least 7–12 cm. long, 1–3 cm. thick, the scales numerous, linear, 10–18 mm. long, decidedly reddish brown to burnt umber, without a black median line. Sterile fronds 65–115 cm. long; stipes scattered, 15–27 cm. long, not at all or but slightly angulate, irregularly marked with vestigial pinnae in the upper part, bicolored (uniformly straw-colored in one frond, *Lloyd 898*); lamina 30–90

cm. long, 12–28 cm. wide, lanceolate to ovate-lanceolate, abruptly reduced at the base (type D to E, with vestigial pinnae), gradually reduced at the apex, the terminal pinna 4–7 cm. long, the pinnae usually alternate, distant (1–2 cm.) in the lower third or half of the lamina; pinnae 28–60-jugate, linear, slightly curved to falcate, the apex long-acuminate, the base dilated in the upper part of the lamina, sometimes slightly contracted near the base in the lower pinnae, 7–16 cm. long, about 1 cm. wide (1–2 cm. at the dilated bases); margins entire (apparently subentire in the heavier ones owing to the shrinkage of the tissue between the vein apices); leaf tissue membranous to herbaceous, without scales; veins distinct above in membranous specimens, often appearing below as fine black lines, the glandular apices rather inconspicuous, often blackish, the vein spaces 10–14 to 1 cm. Sporophyls 40–70 cm. long; stipes 12–25 cm. long, with scarlike vestigial pinnae, brownish yellow to dull or purplish brown, or indistinctly bicolored; lamina 18–58 cm. long, abruptly reduced at the base, gradually reduced at the apex; pinnae 20–60-jugate, 7–15 cm. long, 2–4 mm. wide, usually having a sterile tip 1–3 mm. long, the base slightly contracted (sometimes with slight, thin dilations below the contraction); indusium entire, not becoming lacerate, often reflexed; sporangia dark brown.

TYPE: From Martinique, Plumier, Foug. *pl. 90.* 1705.

DISTRIBUTION: Known from Montserrat, Guadeloupe, Dominica, and Martinique.

SPECIMENS INCLUDED: GUADELOUPE: Climbing epiphyte, "Forêts de la Decouverte," *Duss 4168* (Y, N). DOMINICA: Mt. Diablotin, *Lloyd 898* (Y, N). MARTINIQUE: "Mt. de la Calebasse," *Berlanger 814* (Geneva; tracing, Y). Climbing on trees, "Forêţs Deux Choux," *Duss 1555* (Y). Climbing on trees, Calebasse, *Duss 4588* (Y).

The four islands furnishing the specimens of *S. Plumieri* studied (23 sheets), lie near the middle of a chain of islands extending from Yucatan to South America. Passing either northwest or south along that chain, we find plants intermediate in character between *S. Plumieri* and the following, more widely distributed species, *S. polypodioides*. Of the few specimens from Grenada, four sheets (*Sherring 146*) are like *S. Plumieri* in the following respects: The rhizome scales lack the black median line; the stipe is marked with vestigial pinnae; the sterile lamina has the base rather abruptly reduced; the pinnae are very long; and the lower

pinnae are sometimes distant. They are like *S. polypodioides* in the proportionate length of the lamina and in the more falcate pinnae. The other specimens from Grenada fall unquestionably into *S. polypodioides*.

We find similar intermediate forms in passing northwest from Guadeloupe through Porto Rico. One sheet from Porto Rico (*Hioram 275*, Mt. Torresilla, U. S. National Herbarium no. 657235) has the texture and the base of *S. Plumieri;* the other characters are all those of *S. polypodioides*. The other (5) specimens from Porto Rico are all of the *polypodioides* type except that none of them has black in the rhizome scales. This black median line is also lacking in 4 of the 28 Jamaican sheets of *S. polypodioides*, and occasionally so in specimens from Cuba and Mexico.*

Fée's description and picture of *Lomaria Plumieri* can not be separated from *L. Plumieri* Desv., and Fée himself says that his figure is given to "complete" Plumier's figure. Jenman nevertheless confused *Plumieri* with *exaltata*, thus (1) making his description of the habit of *Plumieri* untrue, and (2) leading to the establishment of *Féei* for what he mistakenly considered Fée's *Plumieri*, the raised-veined form of *polypodioides*. Christensen gives *Lomaria divergens* Kze. and *L. mucronata* Fée both as synonyms for *Plumieri*. Neither is synonymous, for *L. divergens* has pinnae with wedge-shaped bases, and *L. mucronata* is much like *exaltata* in the cutting and the proportions of the lamina and the pinnae.

7. S. POLYPODIOIDES (Sw.) Trev. Atti Ist. Ven. III. **14**: 571. 1869.

Osmunda polypodioides Sw. Prod. 127. 1788.

Blechnum onocleoides Sw. Jour. Bot. Schrad. **1800**[2]: 75. 1801.

Onoclea polypodioides Sw. Fl. Ind. Occ. **3**: 1585. 1806.

Lomaria polypodioides Desv. Prod. 288. 1827.

Lomaria onocleoides Spreng. Syst. **4**: 62. 1827.

Lomaria fragilis Liebm. Vid. Selsk. Skr. V. **1**: 80. 1849.

Spicanta onocleoides Presl, Epim. Bot. 114. 1851.

Lomaria decrescens Fée, Gen. Fil. 68. 1852; Mém. Foug. **7**: 24. *pl. 9, f. 1.* 1857.

Lomaria mexicana Fée, Mém. Foug. **8**: 70. 1857.

* See also the discussion under *S. polypodioides*.

Blechnum polypodioides Kuhn, Fil. Afr. 92. 1868.
Spicanta polypodioides O. Kuntze, Rev. Gen. Pl. **2**: 821. 1891.
Spicanta attenuata O. Kuntze, Rev. Gen. Pl. **2**: 820. 1891.
Lomaria Féei Jenm. Bull. Bot. Dept. Jamaica **43**: 7. 1893.
Lomaria attenuata Willd. (as used by Jenman, loc. cit.).
Blechnum attenuatum Diels (in part), in E. & P. Nat. Pfl. **1**[4]: 249. 1899.

Plants epiphytic. Rhizome wide-creeping, often 10–12 meters above the ground, 1–2 cm. thick, the scales linear, 7–14 mm. long, maroon to dark chocolate brown, usually with a black median line. Sterile fronds 25–95 cm. long; stipes scattered throughout 10–20 cm. from the apex of the rhizome, 6–28 cm. long, rarely angulate, without vestigial pinnae, bicolored with dark brown or blackish brown; lamina 20–80 cm. long, 4–15 cm. wide, shape either (1) narrowly lanceolate or else very narrowly oblong or linear with the greatest width the same for about half the length (15–30 cm.), gradually reduced at each end, the lower usually contiguous pinnae becoming triangular or more or less semicircular (type F base and approaching G) or (2) lanceolate in shape, gradually reduced at the apex, the lower sinuses becoming wider and the lower pinnae more abruptly reduced and sometimes distant (type F and approaching E, but rarely E), the pinnae mainly alternate; pinnae 25–75-jugate, falcate, the apex acute to acuminate, the base the widest part, but not very prominently dilated, 2.2–8 cm. long, 9–12 mm. wide; margins entire or sometimes subentire at the apex; leaf tissue rigid-herbaceous to coriaceous, without scales; veins usually indistinct above, usually appearing below as distinct, dark lines, or in the heavier plants often raised and cartilaginous, the apices somewhat glandular, the vein spaces 9–12 to 1 cm. Sporophyls 20–70 cm. long; stipes 8–24 cm. long, often with a few vestigial pinnae, usually bicolored; lamina 16–60 cm. long, abruptly reduced at the base, gradually reduced at the apex; pinnae 22–45-jugate, 3–8 cm. long, 2–3 mm. wide, with or without a contracted sterile tip 1–4 mm. long, not dilated at the base; indusium entire, not becoming lacerate; sporangia brown to dark brown.

TYPE LOCALITY: Jamaica.

DISTRIBUTION: Mexico, Central America, Panama, West Indies, and the Lesser Antilles.

SPECIMENS INCLUDED: MEXICO: State of Vera Cruz, County of Cordova, *Finck 87* (Y, N). COSTA RICA: Vicinity of Coliblanco, altitude about 1,950 m., climbing on trees, *Maxon 251* (Y, N).

Cañas Gardas, altitude 1,100 m., *Pittier 10987* (N). PANAMA: Cana and vicinity, altitude 6,000 ft., on tree, *Williams 923* (Y, N). CUBA: Without locality, *Wright 864* (Y, N). El Yunque Mt., Baracoa, climbing on tree fern, sink hole, *Underwood & Earle 980* (Y, N). JAMAICA: "Morce's Gap," altitude 5,000 ft., *Clute 81* (Y, N). Base of John Crow Peak, altitude 5,000–5,500 ft., climbing high on a tree, *Maxon 1249* (*Underwood 2377*) (N). Base of John Crow Peak, altitude 5,000–5,500 ft., *Underwood 558* (Y). HAITI: La Brande to Mt. Balance, creeping on tree, summit of Mt. Balance, *Nash & Taylor 1749* (Y). SANTO DOMINGO: Constanza, epiphytic in leafy woods, altitude 1,200 m., *von Türckheim 2996* (Y). PORTO RICO: Luquillo Mountains, *Wilson 142*.

Onoclea polypodioides Sw. is described as having clustered stipes, erect fronds, an inframarginal indusium, and as differing from *Osmunda Spicant* L. in magnitude, in the more acute and more curved pinnae, and in the remote not subconfluent fertile pinnae. These characteristics, taken with the clustered appearance of this scandent species, and with the smaller size of the European *Spicant*, fix the name without doubt upon the Jamaican fern described above. The dimorphous character of this species probably caused Swartz to change the specific name to *onocleoides*, before he finally transferred it to *Onoclea*, where he took again the original specific name *polypodioides*. He plainly states the synonym in each case, so that there is no reason for including both *onocleoides* and *polypodioides* as several fern writers have done.

Several species have been reduced to synonymy with *polypodioides*, either by Christensen or in this paper. Liebmann's own sheet of *L. fragilis* can not be distinguished from young leaves of *L. polypodioides*. The same is true of the picture and of the type sheet of Fée's *L. decrescens* (Cuba, *Linden 2019*); and Fée's description contains too many contradictions to be of any value. *L. mexicana* Fée is later described by Fée as synonymous with *L. fragilis* Liebm. The shorter fertile frond and the lack of any distinctive character even in one of Liebmann's own sheets prevent the separation of *fragilis* from *S. polypodioides*.

Neither can *L. Féei* of Jenman be clearly distinguished from *S. polypodioides* for (1) the same plants show both forms of bases of the

laminae; and (2) the same collection number* has fronds with and also without the raised cartilaginous veins, which are but irregularly present in the plants possessing them. Several plants from Cuba, Haiti, and Jamaica, however, show such veins; they are usually coriaceous in texture, the pinnae are longer and usually *linear*-falcate in shape, and the bases of the laminae are rather more abruptly reduced (type E) with occasionally distant pinnae. These same characters are, however, found in some fronds without the raised cartilaginous veins; and like the veins, they are not uniform in all the fronds of the same plant.

The specimens from Costa Rica and Panama have very long and proportionately narrow sterile fronds, a form evidently commoner in Jamaica than in other islands. These mainland plants differ also from most of the island specimens in having very narrow, acuminate scales, with very long, slender teeth, which are variously curved and often sharply recurved and hooklike. Separation of these plants is impossible, however, because of intermediate forms. Several Mexican plants (*Finck 87*) have similar fronds; the scales are also very like those of the Costa Rican and Panama plants, except that the black median line is often wanting. Among the specimens from Jamaica are several sheets (*Underwood 558* and *Maxon 2725*) which have scale margins intermediate between those described above and the usual island type with short, straighter teeth.

Three sheets from Costa Rica ("Vallée du Dignis," epiphytic exclusively on trees, altitude 700 m., *Tonduz 12005*) are mentioned here chiefly because of their epiphytic habit. The black-centered scales are not long-toothed like the other Costa Rican plants. The entire, linear laminae with winged stipes suggest Kunze's *Lomaria pteropus*.† His plants had similar scales, but much shorter, broader laminae with fewer pinnae, 3–12-jugate probably, while these Tonduz specimens are 17–25-jugate. The stipes of *pteropus* are bordered by straight-edged extensions; in the Tonduz plants the wings are composed of several pairs of confluent, rounded lobes. Kunze describes his plant as barely covered with earth; Tonduz's specimens are positively epiphytic.

* This variation is shown in eight sheets of *Wright 864*, and in single collection numbers of more careful collectors in recent years: Nash, Maxon, and Underwood.

† Kunze, Farrnkr. 97. *pl. 46*. 1840; Raddi, Pl. Bras. 1: 5. *pl. 17*. 1825.

Unfortunately the fertile fronds are lacking; if these Tonduz plants do not belong with *pteropus*, they should nevertheless be separated from *polypodioides*. Without the fertile fronds it is, of course, impossible to place them with certainty.

Two incomplete specimens from Costa Rica ("Forêts du Roble, volcan Frazu," *Pittier & Durand 4132*, and U. S. National Herbarium no. 575238, without definite locality, *Wercklé*) and one from Nicaragua (Omotepec, *C. Wright*) suggest the Tonduz plants in the breadth and texture of the lamina and in the shape of the pinnae; they lack the winged stipes, however.

8. S. SPICANT (L.) Weis, Pl. Crypt. Fl. Gott. 286. 1770.
Osmunda Spicant L. Sp. Pl. 1066. 1753.
Acrostichum Spicant Willd. Prod. Fl. Berol. 289. 1787.
Blechnum Spicant J. E. Sm. Mém. Acad. Turin **5**: 411. 1793.
Onoclea Spicant Hoffm. Deutsch. Fl. **2**: 12. 1795.
Osmunda borealis Salisb. Prod. 402. 1796.
Acrostichum lineatum Cav. Anal. Hist. Nat. **1**: 106. 1799.
Asplenium Spicant Bernh. Jour. Bot. Schrad. **1799**[2]: 309. 1800.
Blechnum boreale Sw. Jour. Bot. Schrad. **1800**[2]: 75. 1801.
Lomaria Spicant Desv. Ges. Nat. Fr. Berl. Mag. **5**: 325. 1811.
Lomaria crenata Presl, Rel. Haenk. **1**: 51. 1825.
Blechnum doodioides Hook. Fl. Bor.-Am. **2**: 263. 1840.
Spicanta borealis Presl, Epim. Bot. 114. 1851.
Struthiopteris doodioides var. Trev. Atti Ist. Ven. III. **14**: 571. 1869.

Plants terrestial. Rhizome more or less inclined, apparently short, 7 mm. to 2 cm. thick, the scales lanceolate, 5–10 mm. long, chestnut to maroon or brown, darker and thicker toward their base. Sterile fronds 20–70 cm. long, of two types: (1) clustered, shorter, spreading, coriaceous or rigid-herbaceous ones with very short stipes and close pinnae, and (2) from the center of those just described, taller, more or less erect, herbaceous fronds with long stipes, much longer pinnae, and wider sinuses; stipes clustered at the apex of the rhizome, 3–27 cm. long, somewhat or not at all angulate, without vestigial pinnae, variously colored, reddish brown, yellowish brown, or purplish chestnut, but not bicolored; lamina 21–60 cm. long, 2–9 cm. wide, narrowly elliptical to linear, very gradually reduced at the base (type G), and gradually reduced at the apex, the pinnae often opposite near the middle or the base of the frond; pinnae 36–80-jugate, oblong-linear to linear-falcate, the apex rounded-acute, the base prominently dilated in

the larger, more open laminae, 1–5 cm. long, 4–10 mm. wide, often opposite, especially near the base; margins entire, irregularly revolute in some of the smaller, heavier fronds only; leaf tissue membranous to coriaceous as previously described, a few of the thinner ones somewhat punctate as in *S. exaltata*, without scales, except rarely a few minute fibrillose ones on the rachis; veins* neither raised nor grooved, the apices but slightly or not at all glandular, vein spaces 10–15 to 1 cm. Sporophyls 38–120 cm. long; stipes 11–60 cm. long, often marked for a short distance by vestigial pinnae, darker than the sterile; lamina 19–60 cm. long, 4–10 cm. wide, very gradually reduced at the base and at the apex; pinnae 40–50-jugate, 2.2–5 cm. long, 2–3 mm. wide, the apex acute, with or without a contracted sterile tip 1–2 mm. long, the base decidedly dilated; indusium membranous, usually entire or subentire, sometimes irregularly broken, never becoming lacerate; sporangia dark brown.

DISTRIBUTION: Pacific coast from California to Alaska.

SPECIMENS† INCLUDED: CALIFORNIA: Humboldt County, damp shady woods, *Kellogg & Hartford 1175*. OREGON: Nehalum, creek banks and dry woods, *Kirkwood 110*. WASHINGTON: Near Tacoma, shady ravines and springs, *Flett 2030*. BRITISH COLUMBIA: Revelstoke, woods, altitude 1,600 ft., *Shaw 835*. Stevens Pass, altitude 1,150 m., *Sandberg & Leiberg 774*. ALASKA: Windham Bay, *Culbertson 4936*. Ketchikan, near stream leading from Ketchikan Falls, *Broadhurst 101*.

Two fronds collected by Douglas in the interior of northwestern America (exact locality not given) formed the type of Hooker's *Blechnum doodioides;* the half sterile, half fertile leaves, with their occasionally forked pinnae indicate an abnormal condition, and could not be considered as characterizing a valid species. Similar abnormal forms are not uncommon in other species of this genus. The veining of the fertile pinnae and the short, often unconnected sori suggest *Woodwardia* or *Doodia*. The costal sori are characteristic of *Blechnum*, but there are no Blechnums in this region. Abnormal fronds in other species often show great vari-

* The veins are normally once forked; but the *crenata* variety is often twice forked; if the margin is deeply crenate, one main vein may have two or three veinlets on each side. Another variation in the veining is found in *Umbach 611* from Skykomish, Washington, where an apparently normal *S. Spicant* has anastomosing veins in the lower half of many of the pinnae; the veins form one row of areolae along the midrib, and do not branch again before reaching the margin.

† These specimens are all in the herbarium of the New York Botanical Garden.

ation in the width of the sterile part of the fertile pinnae. The plants described under *Blechnum doodioides* therefore without doubt represent abnormal forms of *S. Spicant*, which Hooker* admits is "the only Lomarioid plant in so northern a latitude"; the general shape, the cutting, and the dark stipes support this supposition. *L. crenata* Presl (type from Vancouver Island) is described as differing from *S. Spicant* in being larger, and in having acute, crenate pinnae, the lower ones deflexed and ear-shaped. These characters are found in five sheets from Washington and Oregon (Howell's collections of 1876, 1879, and 1880 and in Flett's no. 1928); Flett's collecting note says: "this form is rare and seems to be confined to the largest plants in the dense, mossy woods." The name *L. Spicant*, var. *serratus* Wall. appears on some of these sheets. No further record of this name has been found.

9. **S. stolonifera** (Mett.) Broadh. comb. nov.

Blechnum stoloniferum Mett. in herb. Meissn.; Fourn. Mex. Pl. 1: 113. 1872.

Lomaria stolonifera Fourn. Mex. Pl. 1: 113. 1872.

Lomaria Gheisbreghtii Baker; Hook. & Baker, Syn. Fil. ed. 2. 481. 1874.

Spicanta Ghiesbreghtii O. Kuntze, Rev. Pl. 2: 821. 1891.

Blechnum stoloniferum C. Chr. Ind. Fil. 160. 1905.

Blechnum Ghiesbreghtii C. Chr. Ind. Fil. 154. 1905.

Plants terrestrial. Rhizome creeping and stoloniferous, 15 cm. long (in type), slender, 1–2 mm. thick, the scales lanceolate to ovate-lanceolate, 1–4 mm. long, yellowish brown to tobacco brown. Sterile fronds 11–20 cm. long;† stipes clustered, 5 mm. to 4 cm. long, usually slightly angulate, without vestigial pinnae, uniformly castaneous to dark violet or lighter colored in the channel, occasionally with a few ovate-lanceolate to ovate, dull brown deciduous scales; lamina 8–16 cm. long, 17–36 mm. wide, elliptical, gradually reduced at the base (type F) and slightly less so at the apex; pinnae 16–22-jugate, triangular-falcate to oblong-falcate, the apex rounded or obtuse, but often apparently acute because of the irregularly revolute margin, the base more or or less dilated, 6–18 mm. long, 4–5 mm. wide; margins entire, irregularly and but slightly revolute; leaf tissue herbaceous, roughish in drying, never smooth as in the

* Sp. Fil. 3: 60. 1860.

† Usually less than 18 cm. long.

thinner fronds of *S. Spicant*, very finely punctate much as in *S. exaltata*, without scales; veins indistinct, without conspicuous glandular apices, vein spaces 10–12 to 1 cm. Sporophyls taller, 25–28 cm. long; stipes slender, 9–13 cm. long, reddish brown to almost black, usually shining; lamina 7–16 cm. long, abruptly reduced at the base with slight indications of vestigial pinnae or gradually reduced with the lower pinnae sterile, the apex gradually or abruptly reduced; pinnae 12–19-jugate, 1–2 cm. long, 2–3 mm. wide, falcate, with an abrupt sterile tip 1–2 mm. long, the base dilated; indusium delicate, entire; sporangia tobacco brown or darker.

TYPE: *Müller 1491*, no. 61 in Meissner herbarium (Y) from Orizaba, Mexico.

DISTRIBUTION: Known from Mexico only.

SPECIMENS INCLUDED: MEXICO: State of Hidalgo, Trinidad, wet banks, *Pringle 8752* (N). State of Hidalgo, Barranca, below Trinidad Iron Works, 5,700 ft., *Pringle 13808* (N). Chiapas, *Ghiesbreght 207* (Kew; College of Pharmacy, Columbia University).

The type of *L. Gheisbreghtii* Bak., *Ghiesbreght 207*, cannot be distinguished from *S. stolonifera*, though Christensen in his Index Filicum considers it a valid species. One or more of the taller sterile fronds in the two type numbers seen have wider sinuses, giving the lamina a slightly more open appearance than the rest of the fronds of these or of the other specimens of *S. stolonifera*. The College of Pharmacy specimen of *Ghiesbreght 207* has also a short, undeveloped stoloniferous shoot.

S. stolonifera differs from *S. Spicant* in texture, never possessing the smooth almost transparent pinnae of the more delicate specimens nor the coriaceous texture of the smaller fronds of *S. Spicant*. The lamina is much smaller, and the pinnae often lie so close together that the lamina usually appears lobed rather than fully pinnate; the pinnae are never linear, and as indicated in the key, are proportionately much broader than in *S. Spicant*. Three pots of *S. stolonifera*, now in the New York Botanical Garden conservatories, have the shorter sterile fronds arranged in a flattened rosette at the base, one of the taller sterile fronds at an angle of about 30 degrees, and the fertile ones erect or almost so. In this they resemble *S. Spicant;* it would be interesting to know if *S. Spicant* is ever stoloniferous.

(*To be concluded*)

Vegetative reproduction in the New England Frullaniae

ANNIE LORENZ

Very little emphasis has as yet been laid upon the occurrence of adventive branches, or propagula, in the genus *Frullania*, perhaps for the reason that such propagula, at least in the New England species examined by the writer, offer no taxonomic distinctions, as do the gemmae in *Metzgeria*. In any case, but few references to such propagula can be found in the previous literature.

Dr. Evans ('97), in his monograph on the North American Frullaniae, while he makes no reference to such propagula in his introductory remarks, describes the upright flagellate branches of *F. Bolanderi* Aust. but does not ascribe to them any characters of vegetative reproduction. In comparing this species with *F. eboracensis* Gottsche, he says: "*F. eboracensis* occasionally produces flagella-like branches, but they are always leafy, and are a rather unusual feature of the plant"; and in the description of *F. eboracensis*, "sometimes flagelliferous."

However, in his Hepaticae of Puerto Rico ('02–) he describes a variety of adventive branches, propagula and gemmae, arising from different situations upon the plant. Of these, the propagula arising from the modified leaves of *Rectolejeunea flagelliformis* Evans and *Cheilolejeunea decidua* (Spruce) Evans bear the most resemblance to those of the species of *Frullania* which are discussed below.

While a sharp distinction can hardly be made between gemmae and adventive branches or propagula, a gemma, as a rule, grows to a specific size while still united to the parent plant and germinates after being shed. An adventive branch, on the other hand, whether arising from a "Brutblatt" or from some other position upon the plant, begins as an irregular mass of cells and may develop a branch with several leaves before becoming detached.

Berggren ('65) describes in careful detail the propagula upon

the leaves and lobules of *Frullania fragilifolia* Tayl. and figures three lobules with shoots of different ages. Schostakowitsch ('94) treats of the adventive branches of *F. dilatata* (L.) Dum. and *Porella platyphylla* together, figuring a "Vorkeim" of *Porella* which greatly resembles that of our Frullaniae.

Pearson ('02) and Macvicar ('10) refer to the remarkable caducous leaves of *Frullania fragilifolia* but had not observed them to be Brutblätter, although they mention the shoots on the lobules.

Cavers ('03) describes the vegetative reproduction in two European species of *Frullania*. In *F. fragilifolia* Tayl. the easily detached hooded lobules give rise to leafy shoots from their marginal cells. In *F. dilatata* (L.) Dum. "the outer surface of the perianth in this species bears numerous irregular outgrowths, each made up of from two to five or six cells. These outgrowths may be regarded as gemmae." Warnstorf ('03) describes these structures in *F. dilatata* in somewhat more detail, as well as small thin-walled Keimkörner upon the leaves of ♂ plants, and suggests that these two types of gemmae may serve to reproduce the ♀ and ♂ plants respectively.

Hans Buch ('11) merely refers to the Brutblätter of *F. fragilifolia* without any further description.

Of the eleven species of *Frullania* at present reported from New England, seven belong to the subgenus *Trachycolea*, one to *Homotropantha*, two to *Thyopsiella*, and one to *Diastoloba*.

Upon examination, adventive branches were found in three of the species of subgenus *Trachycolea*, viz., *F. eboracensis* Gottsche, *F. Brittoniae* Evans, and *F. riparia* Hampe; as well as in *F. plana* Sull., the representative of subgenus *Homotropantha*. Some scanty material of *F. inflata* Gottsche and *F. saxicola* Aust. was examined fruitlessly, but adventive branches could probably be demonstrated with a larger supply of material.

In the subgenus *Thyopsiella*, material of *F. Asagrayana* Mont. from four different states was examined, with no traces of Brutblätter. *F. Tamarisci* (L.) Dum., both Nova Scotian and Swiss material, gave similar negative results. The same was true of the only *Diastoloba*, *F. Selwyniana* Pearson from Maine.

F. eboracensis Gottsche easily leads all the New England species

in regard to the abundance and luxuriance of its means of vegetative reproduction. As the adventive branches upon all species examined precisely resemble one another, only *F. eboracensis* will be considered in detail and figured. Material was examined from four states, and the Brutblätter were by far the most common upon the Connecticut plants, being observed but once each upon plants from Maine and from Waterville, N. H. These observations and figures have been almost entirely taken from material growing upon *Juniperus* in the vicinity of Dr. Hooker's Cabin, at Farmington, Conn.

Branches with deciduous leaves are frequently produced upon both ♀ and ♂ plants. These may be considered as Brutblätter, as their method of separation is schizolytic, leaving behind one row of cells and the stylus. If a branch is moistened and handled with extreme care, the Brutblätter can be seen in position, but they are excessively fragile.

Whether or not the production of Brutblätter is induced by drought, the cause has evidently no connection with the time of year, as plants collected in January and May from neighboring stations bore equally good Brutblätter. While Brutblätter are equally common upon ♀ and ♂ plants, the writer has not yet observed any upon plants with mature capsules, although thick-walled cells are occasional upon perichaetial bracts as well as upon underleaves. Neither were they observed upon perigonial bracts.

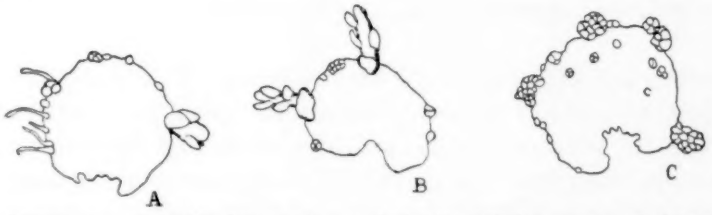

FIGURE 1. *Frullania eboracensis*. *A*, leaf with rhizoids, ×40. *B*, leaf with two shoots, ×40. *C*, leaf with seventeen cell masses, ×40.

The leaves themselves often develop rhizoids, by the projection and lengthening of marginal cells, thus being prepared to get a foothold wherever the leaves happen to be shed. (FIG. 1, *A*.)

The gemmalike masses of cells are developed from the margin

or from the row or two of cells just within. A single favorable leaf may have eight or ten marginal cells in various stages of division, making quite a border, besides one or two entire shoots with more or less developed leaves. (FIG. 1, *B*.) The largest number of cell masses counted by the writer upon any one leaf is seventeen, but these were not all marginal. (FIG. 1, *C*.)

A marginal cell first becomes more or less pigmented with red-brown, or rather, with burnt sienna mixed with a very little carmin lake and just a touch of black, so that it is strikingly contrasted with the clear green of the rest of the leaf; or if upon red ♂ plants, the color becomes still deeper and richer. The cell wall thickens, and the cell expands and projects beyond the margin to some extent. (FIG. 2, *A*.) It first divides by a wall perpendicular to the margin, making two approximately hemispherical cells. These divide next in a plane about in line with the margin, but this is not a continuous line, so that the four resulting cells are

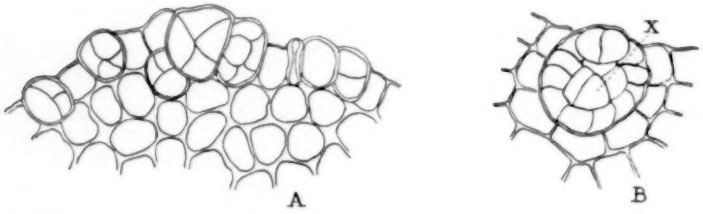

FIGURE 2. *A*, margin of leaf with cells in various stages of division: note the cell that has been compressed by its neighbors; ×250. *B*, further developed cell mass, showing triangular apical cell in center, ×250.

not all of quite the same size. They in turn divide in a plane about parallel to the leaf surface. One of the outer cells cuts out a three-sided pyramidal apical cell (FIG. 2, *B*), and the leafy shoot arises directly from this, without having first become detached from the leaf and while the leaf is still growing upon the plant.

The lobules bear, with equal frequency, cell masses and shoots either upon the top of the hood or about its mouth. (FIG. 3, *A*, *B*.) A few hoods had shoots so well developed that several of the upper leaves had hoods of their own. (FIG. 3, *C*.)

The first leaves on the shoots are mere rudiments, but succeeding leaves are increasingly developed, and underleaves soon

appear. (FIG. 3, *D*). The largest shoots have quite the aspect of normal branches. (FIG. 3, *E*.)

On some fresh material from Farmington, growing on young elm trees in a bog, the cell structure of the leaves differed in being thinner-walled, with less conspicuous trigones and almost no intermediate thickenings. This condition approaches that of *F. Bolanderi* Aust. of the Pacific coast, which besides its characteristic upright flagellate shoots has Brutblätter exactly like those first described for *F. eboracensis*.

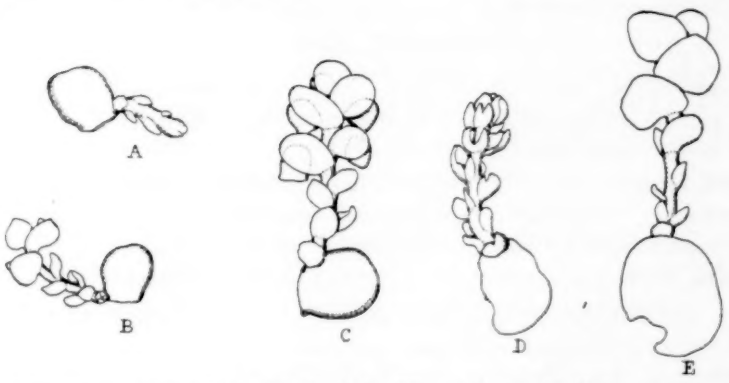

FIGURE 3. *A–C*, hoods with shoots in different stages; *D*, *E*, leaves with well developed shoots.

In *F. riparia* Hampe from North Pownal, Vermont, the Bruchblätter were not caducous, and the cell masses as a rule were not marginal but arose from cells about two rows back from the margin.

F. Brittoniae Evans, which is very close to the European *F. dilatata*, in some material from Waterville, N. H., bore cell masses and shoots upon leaves likewise not caducous.

The adventive branches in *F. plana* Sull. are borne, not upon the oldest and more or less dirt-encrusted portions of the plant, but upon the growth of the past season. These leaves also were not caducous, neither did they produce rhizoids. The adventive branches closely resemble those of *F. eboracensis*, except that they are of a rather dark green instead of being pigmented with red-brown.

According to these observations, the production of Brutblätter

is more frequent in the dioicous rather than in the autoicous species of *Frullania*. *F. eboracensis*, *F. Brittoniae*, and *F. riparia* are all dioicous, as is *F. Bolanderi;* while *F. plana*, although autoicous, is usually sterile. All the European species of *Frullania*, with the exception of the recently described *F. cleistostoma* Schiffner & Wollny, are dioicous.

The writer would express her thanks to Dr. A. W. Evans for his kind assistance; and would be glad to examine any further propagula-bearing material of *Frullania*, other than *F. eboracensis*.

HARTFORD, CONNECTICUT.

BIBLIOGRAPHY

Berggren, S. Iakttagelser öfver mossornas könlösa fortplantning genom groddknoppar och med dem analoga bildningar. 1–33. *pl. 1–4*. Lund, 1865.

Buch, Hans. Über die Brutorgane der Lebermoose. Helsingfors, 1911.

Cavers, F. On asexual reproduction and regeneration in Hepaticae. New Phytol. **2**: 121–133, 155–165. 1903.

Evans, A. W. A revision of the North American species of *Frullania*, a genus of Hepaticae. Trans. Conn. Acad. **10**: 1–39. *pl. 1–15*. 1897.

Evans, A. W. Hepaticae of Puerto Rico—I. *Leptolejeunea*. Bull. Torrey Club. **29**: 496. 1902; II. *Drepanolejeunea*. Bull. Torrey Club **30**: 19. 1903; IV. *Odontolelejeunea*, *Cyclolejeunea* and *Prionolejeunea*. Bull. Torrey Club **31**: 183. 1904; V. *Ceratolejeunea*. Bull. Torrey Club **32**: 273. 1905; VI. *Cheilolejeunea*, *Rectolejeunea*, *Cystolejeunea*, *Pycnolejeunea*. Bull. Torrey Club **33**: 1. 1906; X. *Cololejeunea*, *Leptocolea*, *Aphanolejeunea*. Bull. Torrey Club **38**: 251. 1911.

Macvicar, S. M. Distribution of Hepaticae in Scotland. Trans. Bot. Soc. of Edinburgh **25**: 1–336. 1910.

Pearson, W. H. Hepaticae of the British Isles. 23–35. 1902.

Schostakowitsch, W. Ueber die Reproductions- und Regenerationserscheinungen bei den Lebermoosen. Flora **79**: 350–384. 1894.

Warnstorf, C. Kryptogamenflora der Mark Brandenburg **1**: 273–279. Leipzig, 1903.

New ferns from Tropical America

MARGARET SLOSSON

(WITH PLATE 23)

The discovery of the two plants which are the subject of this paper, adds another species to the already vast genus of *Polypodium* and one to the meager genus of *Loxsomopsis*. The first of these two plants was brought recently from Cuba, by Dr. J. A. Shafer, and belongs to the well-known group of *Polypodium* usually designated as the *P. trifurcatum* group. The second is taken from a large and fine collection of ferns made in Bolivia by Mr. R. S. Williams during 1901 and 1902. This collection contains a number of species still to be described.

The genus *Loxsomopsis* has been known until now by two species only, found in Costa Rica and Ecuador, respectively. It is one of the most peculiar and striking in the American tropical fern flora. Its most notable characteristic, the minute erect or deflexed, cup-shaped or pitcher-shaped sori, with their extruding columellar receptacles beset with sporangia, suggesting minute lily bells on the margins of the leaves, can be seen from the accompanying illustration of the species here described. This plant, apparently the largest and most conspicuous so far discovered in the genus, may be known as:

Loxsomopsis notabilis sp. nov.

Rhizome creeping, 3 to 5 mm. in diameter, thickly clothed with blackish or purplish castaneous acicular scales 1 to 3 mm. long, the cells of the scale uniserial above its turgid base, the scale sometimes noticeably articulated; fronds borne on top of the rhizome, uniserial, scattered, up to 2.5 m. high, up to about 80 cm. broad, deltoid, bi-subtripinnate; stipe up to about 1.2 m. long, 1.3 to 3 mm. in diameter, purplish ebeneous to castaneous, rigid, terete, clothed below with scales similar to those of the rhizome, glabrous or glabrescent above; primary rachis castaneous and terete below, stramineous and narrowly elate toward the apex; secondary rachises castaneous to stramineous; pinnae opposite or subopposite, sessile or adnate, mostly remote, spreading more or less obliquely, often

arcuate, at least when dried, somewhat asymmetrical, acuminate, the apices serrate to subentire, giving rise gradually to the pinnules; basal pinnae either the broadest, 7 to 25 cm. broad, or equal to the next above, broadly ovate or ovate-lanceolate, median pinnae ovate-lanceolate or lanceolate, upper pinnae lanceolate; pinnules adnate-decurrent, the inner in the inner pinnae mostly spaced, the larger lanceolate or lance-linear, acuminate, cut obliquely almost to the costa into deltoid, ovate-oblong, or oblong-lanceolate, obtuse or acute segments, the larger of which are coarsely and obliquely lobed or toothed; smaller pinnules contiguous and similar to the larger segments; both basal pinnules reduced and sometimes the next pair somewhat so, the basiscopic basal pinnule the shortest, 1.7 cm. or less long, in the upper or median pinnae often merely a toothed auricle and then adnate to the primary rachis; upper surface bright olive green, glabrous, lower surface paler, glaucous, and sparingly furnished with minute flexuose flattened articulated hairs, especially on the veins, costae, and rachises; texture chartaceous; venation prominent, pinnate, veins catadromous; sori terminal on lateral teeth of the lobes or segments, erect or deflexed, each apical on a simple vein, or the upper branch of a once forked vein or a spur produced from the upper side of the latter branch; indusia sessile, calyciform, rarely urceolate, entire; receptacle somewhat exserted; sporangia intermixed with simple articulated paraphyses; spores fuscous, subtetrahedral, convex on the upper side, verrucose.

Type in the Underwood Fern Herbarium at the New York Botanical Garden, collected in wooded ravines, near Apolo, Bolivia, South America, July 25, 1902, *R. S. Williams 1303*.

From *L. costaricensis* Christ* and *L. Lehmanii* Hieronymus,† as described, *L. notabilis* differs chiefly in the following characteristics. From *L. costaricensis*, in the bright olive green upper surface and glaucous under surface of the lamina, in the conspicuous reduction of the principal pinnae at the base on both sides, and in the verrucose spores. *L. costaricensis* is described as having the upper surface of the lamina dark green, the lower surface not glaucous, the basal acroscopic pinnules the longest pinnules of the principal pinnae, and the spores smooth. From *L. Lehmanii*, *L. notabilis* differs in the much greater size of the leaf, in the color, blackish or purplish castaneous to castaneous, of the rhizome, stipes, and their scales, in the shape of the lower

* Bull. Boiss. II. **4**: 399. *pl. 1.* 1904.

† Bot. Jahrb. **34**: 435. 1904.

pinnae, and usually in the shape of the indusia, which for the most part are merely deeply cup-shaped. *L. Lehmanii* is described as having leaves 35 cm. or less long, stipes fuscescent, scales of the stipes and rhizome fuscous-ferrugineous, lower pinnae obliquely elongate-deltoid, and indusia urceolate.

Polypodium insidiosum sp. nov.

Rhizome erect or oblique, about 1.5 cm. or less long, about 3 mm. or more in diameter, the crown thickly clothed with yellowish brown lanceolate or oblong-lanceolate scales 1 to 3 mm. long, having minute, rarely jointed, processes on their margins; stipe dull brownish or blackish, slender, wiry, terete, often arcuate, at least when dried, 0.5 to 3.5 cm. long, glandular-pubescent, clothed at the base with a few scales similar to those of the rhizome; lamina 3 to 10 cm. long, 6 to 13 mm. broad, lanceolate and broadest at or below the middle, or linear, rarely oblanceolate, acute or obtuse, at base acutely cuneate and very shortly decurrent, entire, repand, or somewhat sinuate, glandular-pubescent, glabrescent; the margin and lower surface, especially about the sporangia, sparingly furnished with short brown spreading hairs, a few sometimes on the upper surface also; midvein flexuose, mostly concealed, or slightly evident below and then blackish; texture chartaceous-coriaceous; veins usually apparent by transmitted light; the primary veins mostly with from 2 to 4 pairs of simple or occasionally once forked, free or casually uniting branches; sori apical or dorsal on the innermost branches or on short spurs of these, irregularly 1- to 3-serial, orbicular or oval, 1 to 2 mm. broad, superficial; sporangia glabrous; spores finely papillose.

Type in the Underwood Fern Herbarium at the New York Botanical Garden, collected on mossy tree trunks near Camp La Gloria, a mining camp south of Sierra Moa, Province of Oriente, Cuba, at an altitude of about 762 meters, December 24–30, 1910, *J. A. Shafer 8043*.

This plant strongly suggests a small mock *Polypodium trifurcatum*. It is much smaller than that species, fruiting when barely 3.5 cm. high, and appears to have a somewhat different habit. When dried, the fronds are rigid and very brittle, and the stipes are more or less arcuate; the fronds thus point in various directions, but are not bent abruptly at the base of the lamina, as is apt to be the case in *P. trifurcatum*. The laminae when lobed are less deeply so than is usual in the latter plant and are often either entire or merely subentire.

NEW YORK BOTANICAL GARDEN.

Explanation of plate 23

FIG. 1–3. *Loxsomopsis notabilis; R. S. Williams 1303*, Bolivia; 1, section of pinna, enlarged, showing sori; 2, scale from leaf bud; 3, scales from rhizome.

FIG. 4–8. *Polypodium insidiosum; J. A. Shafer 8043*, Cuba; 4–6, parts of plant, natural size, showing leaf variation; 7, section of leaf, enlarged, showing venation; 8, scale from rhizome.

Three new species of Opuntia, with a discussion of the identity of Opuntia Lindheimeri

Bernard Mackensen

For some years the writer has been studying the opuntias growing in the country about San Antonio, Texas. Among the large, more or less erect forms he has recognized several species described by Dr. David Griffiths in recent years, but of the remaining large forms he has not been able to discover a record anywhere. Among the latter he naturally expected to recognize *Opuntia Lindheimeri*, but careful examination revealed the fact that no single form agrees with Dr. Engelmann's description of that species and with the specimens and notes ascribed to it in the herbarium of the Missouri Botanical Garden; nor has he been able to find such a form at New Braunfels, the type locality of that species.

Of the presumably new species mentioned, three are described below. A certain other species occurs here, characterized by robustness, its height sometimes exceeding two meters, and by its white to yellow spines (resembling bone), etc. Perhaps this species approaches the description of *O. Lindheimeri* more nearly than any other occurring in this region. The two, however, differ in length of bristles, length and color of spines, shape and character of fruit, and size and character of seed. The fruit preserved in the type material of *O. Lindheimeri*, and the sketch of it accompanying them, show that organ to be very slender. None of the larger opuntias of the type locality have such a fruit, so far as the writer has been able to determine, but the low species *Opuntia macrorhiza* and *O. leptocarpa* bear fruit of that form. Some of the type material was taken from plants grown in St. Louis and for that reason is probably not normal, as the opuntias are very readily modified by changed conditions. This fact, together with the unsatisfactory condition of a part of the material, increases the difficulty of establishing the identity of *Opuntia*

Lindheimeri. The seeds in the type material agree with those of *O. macrorhiza*. The writer had long suspected that this species is a composite one, but after his examination of the material and accompanying notes and drawing in the herbarium of the Missouri Botanical Garden he has become firmly convinced that such is the case. There is another fact which supports this view: Lindheimer, in his notes accompanying the specimens of opuntias, uses the expressions "kleine Opuntia" and "grosse Opuntia," which seems to indicate that he regarded all the small flat-jointed opuntias of his region as one species and all the large (more or less erect) ones as another, just as at present most of the inhabitants of that region distinguish but two species, if indeed they recognize more than one.

It would seem that in the composition of *O. Lindheimeri* the tall form mentioned contributed the size and habit, *O. texana* the spines, and *O. macrorhiza* the fruit. All these species occur at New Braunfels. The writer has thought best to let the tall form, of which he has deposited specimens under the number 619757 in the U. S. National Herbarium, stand for *O. Lindheimeri*.

The species described below are closely related, but each, it will be seen, differs from any one of the others in several characters. The descriptions were drawn from plants growing in their native habitat at San Antonio, Texas, where the species are common, and the type material was collected in the same locality.

Opuntia convexa sp. nov.

Plants from somewhat fleshy terete roots, sometimes attaining a height of over 1 meter and a breadth of 2 to 3 meters, with normally erect or ascending stems; joints obovate to oval, often inequilateral and obtuse or acutish at apex, 1.5 to 3 cm. long, or sometimes longer, at first somewhat glaucous, later dull green, darker around the areoles, in age dirty yellow to gray, and scurfy; leaves subulate, somewhat flattened, 5 to 10 mm. long; areoles bearing formidable bristles and short wool, and on the younger joints usually armed, except the lowest; bristles dirty yellow to brown, on old joints widely spreading and attaining a length of 15 mm.; spines light brown to reddish below (soon fading to grayish), but the greater portion of spine pale yellow, straight or often curved, much flattened, mostly twisted, rather stout, unequal, 1 to 4.5 cm. long, or sometimes longer, 1 to 5 to an areole, or on

the older joints sometimes more, very numerous on joints formed in droughty seasons, erect or spreading, on old joints reflexed; flowers opening yellow and turning salmon pink, 7 to 8 cm. broad and long; petals relatively thick, obovate, cuspidate, about 3 cm. broad, 4 to 5 cm. long; stigma green, 7- to 9-lobed, surpassing the stamens; fruit obovate in outline, often broadly so, 3.5 to 4 cm. broad, 4.5 to 5.5 cm. long, dark purplish red without, purple within, the umbilicus convex, the taste nauseous; seeds suborbicular, nearly or quite 4 mm. in diameter, buff, with more or less gray on the flat sides.

The plant flowers in April and May and ripens its fruit, which is often proliferous, in August.

This species is probably the commonest of the various large-jointed prickly pears growing about San Antonio.

The type is no. 619756 in the U. S. National Herbarium.

Opuntia Griffithsiana sp. nov.

Plants from somewhat fleshy terete roots, sometimes attaining a height of 8 and a breadth of 12 dm., with erect, ascending, and prostrate stems, forming a rather dense growth; joints obovate to oval (often broadly so) or circular, thin, 1.5 to 2.5 or sometimes 3 dm. long, the younger pale glaucous, the oldest dirty yellow to grayish, and scurfy; leaves subulate, from very short to 10 mm. in length; areoles bearing formidable bristles and short wool, and on the younger joints usually armed with spines, except below; bristles bright reddish brown when young, dirty yellow to brown when older, attaining on old joints a length of 12 mm.; spines brownish red to brown below (often to the middle), pale yellow or dirty white above, faded in age, straight or sometimes curved, somewhat flattened, mostly twisted, rather slender, unequal, 1 to 4.5 cm. long, or sometimes longer, 1 to 5 to an areole, or on the older joints sometimes more, very numerous on joints formed in droughty seasons, erect or spreading, or on old joints reflexed; flowers light yellow, turning darker (reddish) in center, 7 to 9 cm. broad, 8 to 10 cm. long; petals obovate to cuneate, often narrowly so, 2.5 to 4 cm. broad, 4.5 to 5 cm. long, sometimes emarginate, the midrib ending in a minute point; stigma green, usually 7- or 8-lobed, surpassing the stamens; fruit oblong-obovate to obovate, 3.5 to 4 cm. wide, 5 to 8 cm. long, dark purplish red without, the flesh purple and pale green, with a nauseous taste, the large umbilicus more or less depressed in the center; seeds suborbicular, 4 mm. in diameter, buff, with more or less gray on the flat sides.

The plant flowers in April and May and ripens its fruits, which are not proliferous, from August till winter.

The type is no. 619758 in the U. S. National Herbarium.

The species is named for Dr. David Griffiths, of the U. S. Department of Agriculture.

Opuntia reflexa sp. nov.

Plants from somewhat fleshy terete roots, attaining a height of over 1 meter and breadth of over 2 meters, with erect, ascending, and often long prostrate branches; joints obovate to oval, often broadly so, the apex often obtuse or acutish, 1.5 to 3 dm. long, or sometimes longer, the younger gray-glaucous green, the older yellowish or bluish green, and finally dirty yellow or grayish, and scurfy; leaves subulate, from very short to 10 mm. in length; areoles remote, filled with bristles and short wool, unarmed or bearing 1 or 2 or sometimes 3, and on the older joints often a greater number of spines; bristles, when young, yellow to reddish brown, when older pale dirty yellow, often mottled with brown, on old joints widely spreading and attaining a length of 15 mm.; spines, when young, pale yellow, often mottled with brown or red, when older yellowish white, mostly tinged with red at base, much flattened, mostly twisted, usually very slender, unequal, from very short to 5 or sometimes 7 cm. long, usually much or wholly reflexed; flowers opening yellow and soon turning orange, 8 to 10 cm. broad, 8 to 9 cm. long; petals obovate, cuspidate, 3.5 to 4 cm. broad, 5.5 to 6 cm. long, often some of them reflexed; stigma green, usually 7- or 8-lobed, equaling or slightly surpassing the stamens; fruit obovate in outline, about 4 cm. broad and 5 to 6 cm. long, dark purplish red without, purple within, the umbilicus usually centrally depressed; seeds suborbicular to reniform with a prominent raphe, about 3 mm. long, grayish.

Flowering in April and May. The fruit ripens in August and September and is unpalatable and non-proliferous.

The type is no. 619754 in the U. S. National Herbarium.

SAN ANTONIO, TEXAS.

INDEX TO AMERICAN BOTANICAL LITERATURE

(1909-1912)

The aim of this Index is to include all current botanical literature written by Americans, published in America, or based upon American material; the word America being used in the broadest sense.

Reviews, and papers that relate exclusively to forestry, agriculture, horticulture, manufactured products of vegetable origin, or laboratory methods are not included, and no attempt is made to index the literature of bacteriology. An occasional exception is made in favor of some paper appearing in an American periodical which is devoted wholly to botany. Reprints are not mentioned unless they differ from the original in some important particular. If users of the Index will call the attention of the editor to errors or omissions, their kindness will be appreciated.

This Index is reprinted monthly on cards, and furnished in this form to subscribers at the rate of one cent for each card. Selections of cards are not permitted; each subscriber must take all cards published during the term of his subscription. Correspondence relating to the card issue should be addressed to the Treasurer of the Torrey Botanical Club.

Arthur, J. C. *Aecidiaceae* (continuatio). N. Am. Fl. **7**: 161–187, 211–268. 15 Ap 1912.

The part on *Gymnosporangium*, pp. 188–211, contributed by F. D. Kern.

Barnhart, J. H. Honorary members of the Torrey Club. Torreya **12**: 90, 91. 17 Ap 1912.

Barrett, J. T. Development and sexuality of some species of *Olpidiopsis* (Cornu) Fischer. Ann. Bot. **26**: 209–238. *pl. 23–26.* Ja 1912.

Bassett, G. W. Trials and pleasures of the collector. Bartonia **4**: 11–13. Mr 1912.

Berry, E. W. Some ancestors of the persimmon. Plant World **15**: 15–21. *f. 1–7.* Ja 1912.

Bliss, M. C. A contribution to the life-history of *Viola*. Ann. Bot. **26**: 155–163. *pl. 17–19.* Ja 1912.

Brainerd, E. Violet hybrids between species of the *palmata* group. Bull. Torrey Club **39**: 85–97. *pl. 5–7.* 18 Ap 1912.

Briggs, L. J., & Shantz, H. L. The relative wilting coefficient for different plants. Bot. Gaz. **53**: 229–235. 15 Mr 1912.

Brooks, C., & Black, C. A. Apple fruit spot and quince blotch. Phytopathology **2**: 63–72. *pl. 4, 5.* Ap 1912.

Bunzel, H. H. The measurement of the oxidase content of plant juices. U. S. Dept. Agr. Plant Ind. Bull. 238: 5–40. *pl. 1, 2 + f. 1–9.* 9 Mr 1912.

Clute, W. N. The male fern. Fern Bull. **19**: 97–102. [Ap 1912.] [Illust.]

[Clute, W. N.] Pteridographia. Fern Bull. **19**: 119–124. [Ap 1912.]
Includes notes on, (*a*) Ferns for the house; (*b*) Black spleenwort in America; (*c*) Crested ferns; (*d*) Crested marginal shield fern; (*e*) Living ferns found fossil.

[Clute, W. N.] Rare forms of fernworts—XX. The forms of ebony spleenwort. Fern Bull. **19**: 115–117. [Ap 1912.] [Illust.]

Cockayne, L. Some noteworthy New Zealand ferns. Plant World **15**: 49–59. *f. 1–3.* Mr 1912.

Cockerell, T. D. A. The Colorado *Tradescantia.* Torreya **12**: 89. 17 Ap 1912.

Cockerell, T. D. A. The red sunflower. Pop. Sci. Mo. **80**: 373–382. Ap 1912. [Illust.]

Cogniaux, A. *Orchidaceae*—II. [In Ex herbario Hassleriano: Novitates paraguarienses. XIV.] Repert. Sp. Nov. **10**: 343, 344. 20 F 1912.

Collins, F. S. The botanical and other papers of the Wilkes exploring expedition. Rhodora **14**: 57–68. 8 Ap 1912.

Collins, F. S. The green algae of North America, supplementary paper. Tufts College Stud. **3**: 69–109. *pl. 1, 2.* Ap 1912.
Includes several new species, varieties, and combinations.

Collins, F. S. The marine algae of Casco Bay. Proc. Portland Soc. Nat. Hist. **2**: 257–282. 1911.

Cook, O. F. Phenotypes, genotypes, and gens. Science II. **35**: 654–656. 26 Ap 1912.

Coulter, J. M. Modern aspects of paleobotany—II. The relations of paleobotany to botany. 1. Phylogeny and taxonomy. Am. Nat. **46**: 215–225. Ap 1912.

Dachnowski, A. The successions of vegetation in Ohio lakes and peat deposits. Plant World **15**: 25–39. F 1912.

Dowell, C. P. Our forest trees. Proc. Staten I. Assoc. **3**: 144–147. 15 F 1912.

Dowell, P. Additions to the flora of Staten Island. Proc. Staten I. Assoc. **3**: 156–162. 25 Ap 1912.

Dowell, P. Notes on some Staten Island ferns. Proc. Staten I. Assoc. **3**: 163–168. 25 Ap 1912.

Dox, A. W. Enzyme studies of lower fungi. Plant World **15**: 40–43. F 1912.

East, E. M. A study of hybrids between *Nicotiana Bigelovii* and *N. quadrivalvis.* Bot. Gaz. **53**: 243–248. *f. 1–4.* 15 Mr 1912.

Emerson, R. A. Production of a white bean lacking the factor for

total pigmentation—a prophecy fulfilled. Proc. Am. Breed. Assoc. **6**: 396, 397. 1911.

Evans, A. W. Branching in the leafy *Hepaticae*. Ann. Bot. **26**: 1–37. *f. 1–36*. Ja 1912.

Fedde, F. Neue Arten aus der Verwandtschaft der *Corydalis aurea* Willd. von Nord-Amerika—II. Repert. Sp. Nov. **10**: 364, 365. 20 F 1912.

Fernald, M. L. An early collection of *Salix balsamifera*. Rhodora **14**: 69, 70. 8 Ap 1912.

Fernald, M. L. *Salix serissima* in southern Connecticut. Rhodora **14**: 80. 8 Ap 1912.

Ferguson, M. C. Susan Maria Hallowell. Bot. Gaz. **53**: 345–347. 15 Ap 1912. [Illust.]

Forbes, C. N. New Hawaiian plants—III. Occas. Papers Bishop Mus. **5**: 4–13. 1912.

Includes descriptions and plates of 5 new species.

Forbes, C. N. Preliminary observations concerning the plant invasion on some of the lava flows of Mauna Loa, Hawaii. Occas. Papers Bishop Mus. **5**: 15–23. 1912.

Fromme, F. D. Sexual fusions and spore development of the flax rust. Bull. Torrey Club **39**: 113–131. *pl. 8, 9*. 18 Ap 1912.

Fyles, F. A swamp. Ottawa Nat. **26**: 17–19. Ap 1912.

Gager, C. S. The Brooklyn Botanic Garden. Pop. Sci. Mo. **80**: 339–345. *f. 1–8*. Ap 1912.

Garman, H. The catalpas and their allies. Kentucky State Univ. Agr. Exp. Sta. Bull. 164: 203–223. *f. 1–18*. 15 F 1912.

Gates, F. C. The vegetation of the beach area in northeastern Illinois and southeastern Wisconsin. Bull. Illinois State Lab. Nat. Hist. **9**: 255–370. *pl. 37–56*. Mr 1912.

Gates, R. R. An onagraceous stem without internodes. New Phytol. **11**: 50–53. *pl. 2, 3*. 29 F 1912.

Giddings, W. J. The chestnut bark disease. W. Virginia Univ. Agr. Exp. Sta. Bull. 137: 209–225. *f. 1–12*. Mr 1912.

Greene, E. L. Certain cruciferous types. Leaflets **2**: 219–221. 11 Ap 1912.

Planodes virginicum, *Polyctenium glabellum*, and *P. bisulcatum* gen. et spp. nov.

Greene, E. L. Miscellaneous specific types—V. Leaflets **2**: 225–228. 11 Ap 1912.

Clematis altheifolia, *Polycodium Langloisii*, *P. oliganthum*, *Machaeranthera scoparia*, *Senecio Mesadenia*, and *S. fodinarum* spp. nov.

Greene, E. L. New species of *Chaenactis*. Leaflets **2**: 221–225. 11 Ap 1912.

Eight new species described.

Greene, E. L. Some *Erigeron* segregates. Leaflets **2**: 197–219. 11 Ap 1912.
Continued from Leaflets **2**: 196. 13 Mr 1912.

Greene, F. C. The fern flora of Indiana. Fern Bull. **19**: 102–115. [Ap 1912.] [Illust.]

Griffiths, D. The thornless prickly pears. U. S. Dept. Agr. Farm. Bull. 483: 5–20. *f. 1–4.* 8 Mr 1912.

Grossenbacher, J. G. Crown-rot, arsenical poisoning, and winter-injury. N. Y. Agr. Exp. Sta. Tech. Bull. 12: 369–411. *pl. 1–8.* D 1909.

Grossenbacher, J. G. A *Mycosphaerella* wilt of melons. N. Y. Agr. Exp. Sta. Tech. Bull. 9: 195–229. *pl. 1–6.* F 1909.

Groth, B. H. A. The sweet potato. Contr. Bot. Lab. Univ. Pennsylvania **4**: 1–104. *pl. 1–54.* 1911.

Güssow, H. T. Report of the Dominion botanist. Rep. Exp. Farms (Canada) **1911**: 237–274. *pl. 9–11* + *f. 1, 2.* 1912.

Harris, J. A. The influence of the seed upon the size of the fruit in *Staphylea*—I. Bot. Gaz. **53**: 204–218. *f. 1–4.* 15 Mr 1912.

Hassler, E. *Rutaceae.* [In Ex herbario Hassleriano: Novitates paraguarienses. XIV.] Repert. Sp. Nov. **10**: 344–347. 20 F 1912.

Hassler, E. *Scrophulariaceae.* [In Ex herbario Hassleriano: Novitates paraguarienses. XIV.] Repert. Sp. Nov. **10**: 348. 20 F 1912.

Hassler, E. *Simarubaceae.* [In Ex herbario Hassleriano: Novitates paraguarienses. XIV.] Repert. Sp. Nov. **10**: 347, 348. 20 F 1912.

Hedgcock, G. G. Notes on some diseases of trees in our national forests—II. Phytopathology **2**: 73–80. Ap 1912.

Higgins, J. E. Report of the horticulturist. Ann. Rep. Hawaii Agr. Exp. Sta. **1911**: 25–42. *pl. 1–5.* 9 Ap 1912.
Includes results of investigations on avocado and papaya.

Holden, R. Reduction and reversion in the North American *Salicales.* Ann. Bot. **26**: 165–173. *pl. 20, 21.* Ja 1912.

Hollick, A. Modern aspects of paleobotany—II. Relation of paleobotany to botany. 3. Ecology. Am. Nat. **46**: 239–243. Ap 1912.

Hollick, A. Some features of the Dismal Swamp of Virginia. Jour. N. Y. Bot. Gard. **13**: 53–56. *pl. 91, 92.* Ap 1912.

Hollinshead, M. H. Notes on the seedlings of *Commelina communis* L. Contr. Bot. Lab. Univ. Pennsylvania **3**: 275–287. *pl. 4, 5.* 1911.

Janchen, E. Neuere Vorstellungen über die Phylogenie der Pteridophyten. Mitteil. Naturw. Ver. Univ. Wien **9**: 33–51, 60–67. 1911.

Jeffrey, E. C. Modern aspects of paleobotany—II. The relations of paleobotany to botany. 2. Morphology. Am. Nat. **46**: 225–238. Ap 1912.

Kelley, W. P. The function and distribution of manganese in plants and soils. Hawaii Agr. Exp. Sta. Bull. 26: 5–56. 8 Ap 1912.

Kern, F. D. *Gymnosporangium.* N. Am. Fl. **7**: 188–211. 15 Ap 1912.

Knowlton, C. H. *and others.* Field excursions of the New England Botanical Club. Rhodora **14**: 71–76. 8 Ap 1912.

Knowlton, F. H. Modern aspects of paleobotany—I. The relations of paleobotany to geology. Am. Nat. **46**: 207–215. Ap 1912.

Knowlton, F. H., Coulter, J. M., Jeffrey, E. C., & Hollick, A. Modern aspects of paleobotany. Am. Nat. **46**: 207–243. Ap 1912.
Also indexed separately under each author.

Lewis, C. E. Inoculation experiments with fungi associated with apple leaf spot and canker. Phytopathology **2**: 49–62. Ap 1912.

Lewis, I. F. Alternation of generations in certain *Florideae.* Bot. Gaz. **53**: 236–242. 15 Mr 1912.

Lewis, I. M. Pistillody in *Argemone platyceras* Link and Otto. Torreya **12**: 85–88. *f. 1, 2.* 17 Ap 1912.

Lipman, C. B. Toxic effects of "alkali salts" in soils on soil bacteria. II. Nitrification. Centralb. Bakt. Zweite Abt. **33**: 305–313. *f. 1, 2.* 2 Mr 1912.

Livingston, B. E., & Brown, W. H. Relation of the daily march of transpiration to variations in the water content of foliage leaves. Bot. Gaz. **53**: 309–330. 15 Ap 1912.

Lloyd, C. G. Synopsis of the genus *Hexagona.* 1–46. *f. 276–330.* Cincinnati, O. Je 1910. [Illust.]

Lloyd, C. G. Synopsis of the sections *Microporus, Tabacinus,* and *Funales* of the genus *Polystictus.* 47–70. *f. 336–356.* Cincinnati, O. Au 1910. [Illust.]

Lloyd, C. G. Synopsis of the section *Ovinus* of *Polyporus.* 71–94. *f. 496–509.* O 1911. [Illust.]

Lloyd, C. G. Synopsis of the stipitate polyporoids. 95–208. *f. 395–500.* Mr 1912. [Illust.]

Lloyd, F. E. The relation of transpiration and stomatal movements to the water-content of the leaves in *Fouquieria splendens.* Plant World **15**: 1–14. *f. 1.* Ja 1912.

Long, B. Some results of recent field work in the Cape May peninsula. Bartonia **4**: 14–19. Mr 1912.

MacDougal, D. T. The water-balance of desert plants. Ann. Bot. **26**: 71–93. *pl. 6–10.* Ja 1912.

Macfarlane, J. M. New species of *Nepenthes.* Contr. Bot. Lab. Univ. Pennsylvania **3**: 207–210. *pl. 1, 2.* 1911.
Nepenthes Merrilliana and *N. truncata* spp. nov.

Mackenzie, M. Phyto-phenology in its application to the plants of the Philadelphia neighborhood. Contr. Bot. Lab. Univ. Pennsylvania **3**: 288–427. *pl. 6, 7.* 1911.

Meyer, R. *Echinopsis obrepanda* K. Sch. und *Echinopsis Fiebrigii* Gürke. Monats. Kakteenk. **22**: 33–37. 15 Mr 1912.

Meyer, R. Über *Echinocactus pilosus* Gal. Monats. Kakteenk. **22**: 37–42. 15 Mr 1912. [Illust.]

Mitchell, G. F. The cultivation and manufacture of tea in the United States. U. S. Dept. Agr. Plant Ind. Bull. 234: 5–40. *pl. 1, 2 + f. 1–9.* 15 F 1912.

Includes description of tea plant, *Thea sinensis.*

Morris, E. L. An apparently new record for *Rubus Chamaemorus* Linnaeus. Torreya **12**: 88. 17 Ap 1912.

Nash, G. V. The succulent plant collections. Jour. N. Y. Bot. Gard. **13**: 56–58. Ap 1912.

Nelson, A. Contributions from the Rocky Mountain Herbarium. X. New plants from Idaho. Bot. Gaz. **53**: 219–228. 15 Mr 1912.

Includes descriptions of 14 new species.

Pfeiffer, W. M. The morphology of *Leitneria floridana.* Bot. Gaz. **53**: 189–203. *pl. 18–20.* 15 Mr 1912.

Piper, C. V. Agricultural varieties of the cowpea and immediately related species. U. S. Dept. Agr. Plant Ind. Bull. 229: 5–160. *pl. 1–12.* 29 F 1912.

Vigna unguiculata.

Pollard, C. L. Conservation, the national issue. Proc. Staten I. Assoc. **3**: 128–143. 15 F 1912.

Pretz, H. W. Some noteworthy plants of Lehigh County, Pa. Bartonia **4**: 6–10. Mr 1912.

Reed, G. M. Infection experiments with the powdery mildew of wheat. Phytopathology **2**: 81–87. Ap 1912.

Rivas, D. Bacteria and other fungi in relation to the soil. Contr. Bot. Lab. Univ. Pennsylvania **3**: 243–274. 1911.

Rydberg, P. A. *Epipactis* vs. *Peramium.* Torreya **12**: 89, 90. 17 Ap 1912.

Rydberg, P. A. Phytogeography and its relation to taxonomy and other branches of science. Torreya **12**: 73–85. 17 Ap 1912.

Sands, W. N. An account of the return of vegetation and the revival of agriculture in the area devastated by the Soufrière of St. Vincent in 1902–3. West Ind. Bull. **12**: 22–33. 15 Ja 1912. [Illust.]

Schneider, A. Pharmacal plants and their culture. California State Board Forest. Bull. **2**: 3–175. 1912.

Scott, C. A. The hardy catalpa. Kansas State Agr. Col. Exp. Sta. Circ. 20: 1–19. [1912.] [Illust.]
Catalpa speciosa.

Shear, C. L. The chestnut bark fungus, *Diaporthe parasitica*. Phytopathology **2**: 88, 89. Ap 1912.

Snow, J. W. Two epiphytic algae: a correction. Bot. Gaz. **53**: 347. 15 Ap 1912.

Spaulding, P., & Field, E. C. Two dangerous imported plant diseases. U. S. Dept. Agr. Farm. Bull. 489: 5–29. *f. 1–3*. 9 Ap 1912.
Peridermium Strobi Klebahn and *Chrysophlyctis endobiotica* Schilb.

Spillman, W. J. Application of the principles of heredity to the improvement of plants and animals. Proc. Am. Breed. Assoc. **6**: 397–419. 1911.

Spillman, W. J. A theory of Mendelian phenomena. Proc. Am. Breed. Assoc. **6**: 78–90. 1911.

Stevens, N. E. Observations on heterostylous plants. Bot. Gaz. **53**: 277–308. *pl. 21–23*. 15 Ap 1912.

Steward, J. R. Variability of the maize plant. Proc. Am. Breed. Assoc. **6**: 245–252. 1911.

Stewart, A. Expedition of the California Academy of Sciences to the Galapagos Islands 1905–1906—V. Notes on the botany of Cocos Island. Proc. Calif. Acad. Sci. **1**: 375–404. *pl. 31–34*. 19 Ja 1912.

Stone, W. *Abama americana* (Ker) Morong. Bartonia **4**: 1–5. Mr 1912. [Illust.]

Stout, A. B. A sclerotium disease of blue joint and other grasses. Univ. Wisconsin Agr. Exp. Sta. Research Bull. 18: 207–253. *f. 1–8*. [Mr 1912.]

Stover, W. G. The *Agaricaceae* of Ohio. A preliminary report with keys to the genera and species. Proc. Ohio State Acad. Sci. **5**: 462–577. Mr 1912.

Taubenhaus, J. J. A study of some Gloeosporiums and their relation to a sweet pea disease. Phytopathology **1**: 196–202. *pl. 30* + *f. 1–12*. D 1911.

Theissen, F. Fragmenta brasilica V nebst Besprechung einiger palaeotropischer *Microthyriaceen*. Ann. Myc. **10**: 159–204. 1 Ap 1912.

Theissen, F. *Hymenomycetes* riograndenses. Broteria **10**: 5–28. *pl. 1–4*. Ap 1912.

Thompson, R. B., & Allin, A. E. Do the *Abietineae* extend to the Carboniferous? Bot. Gaz. **53**: 339–344. *pl. 26* + *f. 1, 2*. 15 Ap 1912.

Thompson, W. P. Ray tracheids in *Abies*. Bot. Gaz. **53**: 331–338. *pl. 24, 25*. 15 Ap 1912.

Trelease, W. The agaves of Lower California. Ann. Rep. Missouri Bot. Gard. **22**: 37–65. *pl. 18–72*. 14 F 1912.

Trelease, W. Revision of the agaves of the group *Applanatae*. Ann. Rep. Missouri Bot. Gard. **22**: 85–97. *pl. 73–99*. 14 F 1912.

Ulrich, E. B. Leaf movements in the family *Oxalidaceae*. Contr. Bot. Lab. Univ. Pennsylvania **3**: 211–242. *pl. 3 + f. 1–5*. 1911.

Waldron, L. R. Large and small seed experiment. Am. Breed. Assoc. **6**: 204–212. 1911.

Weingart, W. *Cereus Purpusii* Weingart. Monats. Kakteenk. **22**: 26–29. 15 F 1912. [Illust.]

Weingart, W. *Pilocereus scoparius* Pos. Monats. Kakteenk. **22**: 45. 15 Mr 1912.

Wester, P. J. The mango. Philip. Bur. Agr. Bull. 18: 1–60. *pl. 1–9*. 1911.

Westgate, J. M., & Vinall, H. N. Sweet clover. U. S. Dept. Agr. Farm. Bull. 485: 5–39. *f. 1–16*. 12 Mr 1912.

Williams, R. S. The genus *Clastobryum* Doz. and Molk. in America. Bryologist **15**: 31. Mr 1912.

Wilson, P. Botanical exploration in Cuba. Jour. N. Y. Bot. Gard. **13**: 23–25. F 1912.

Peltostigma pteleoides.

Wilson, P. The flowering of the Jamaica candle-wood tree. Jour. N. Y. Bot. Gard. **13**: 25, 26. F 1912.

Wolf, F. A. Gummosis. Plant World **15**: 60–66. Mr 1912.

Wolf, F. A. Some fungous diseases of the prickly pear, *Opuntia Lindheimeri* Engelm. Ann. Myc. **10**: 113–134. *pl. 1–3 + f. 1–8*. 1 Ap 1912.

Wright, C. H. Flora of the Falkland Islands. Jour. Linn. Soc. Bot. **39**: 313–339. 1911.

York, H. H. The development of the flower, embryo sac, and embryo of *Dendrophthora opuntioides* and *D. gracile[is]*. Johns Hopkins Univ. Circ. **1912**: 149–152. F 1912.

Zahlbruckner, A. Schedae ad "Kryptogamas exsiccatas." Ann. Naturhist. Hofmus. **24**: 269–292. 1910; **25**: 223–252. 1911.

Includes notes on several species from America.